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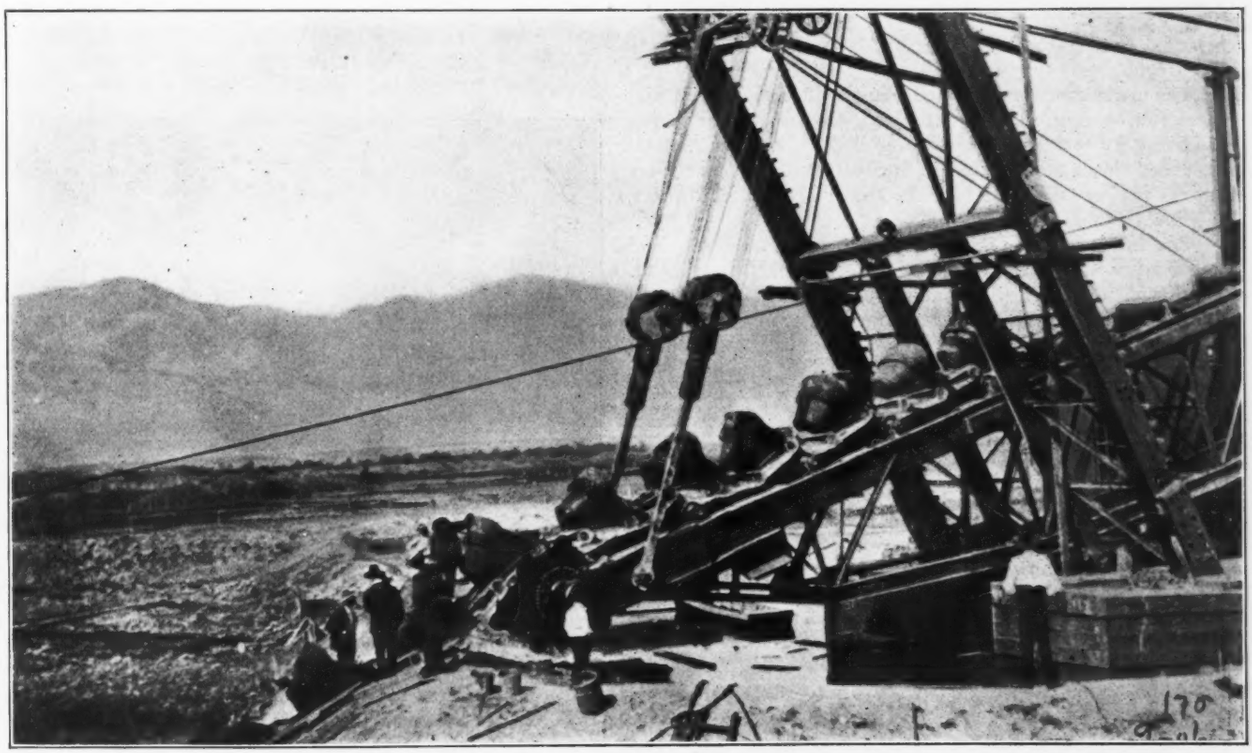
Electric Gold Dredge "No. 3," of Conrey Placer Mining Company, at Ruby, Montana

The Conrey Placer Mining Company, at Ruby, Montana, has in commission three gold dredges, operating at the mouth of Alder Gulch, Madison County, State of Montana. This gulch is historic for the large amount of gold extracted therefrom by the pioneers in the "sixties" and later.

Two of the Conrey Company dredges are operated by steam, one having first started operations in 1899 and the other in 1902.

for operating in the winter months of such a severe climate, which it was thought could be provided more satisfactorily and efficiently by the condensation and radiation of a steam plant.

It was decided, however, to equip the next dredge with electrical machinery, using a supplemental steam heating system for the colder months.



BUCKETS BEING PLACED ON THE LADDER, LADDER HAVING BEEN FASTENED TO THE HEAD STOCK OF DREDGE.

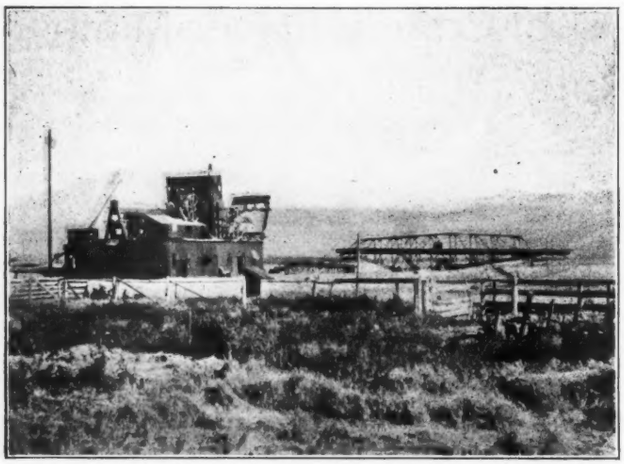
Since then the art of dredging in compact auriferous gravels has advanced so much, and the practice so thoroughly established on safe mechanical lines, that much thought has been given to the perfecting and cheapening of the operating methods. In California it is the general practice to use electric power, but this has been slow of adoption on the Conrey property, owing, first, to the belief that the character of the ground presented difficulties that could be met more readily with the steam power; and, second, to the need of artificial heat, both in the water and air,

This third dredge is of the single lift, sluice-box type. It was built entirely from designs made by the owners. The hull is 130 feet long by 48 feet wide, giving it probably as much if not more area than any other dredge of its kind ever built. It is 8 feet deep and thoroughly trussed for all the known strains. The ladder-way, or well, in the center of the forward part, and in which the bucket chain and ladder work, is 64 feet 9 inches by 7 feet 3 inches.

The ladder is 100 feet from center to center of tumblers. It is of bridgework construction, built up of angles, a lattice

truss, and a plate bottom connecting the lower ends of the side flanges. This bottom or cross-plate serves the double purpose of strengthening the structure and providing a trough for some of the slop and spill of the buckets to return to the point of digging under the water.

The bucket chain is of the open-connected type at present, with 41 buckets and 41 space links. The bucket complete, with manganese lip and sheet steel hood, weighs 2600 pounds. The space link weighs about 1400 pounds. They are all fitted in the back eyes with manganese circular bushings, and connected together with high carbon steel pins 5⅜ inches in diameter.



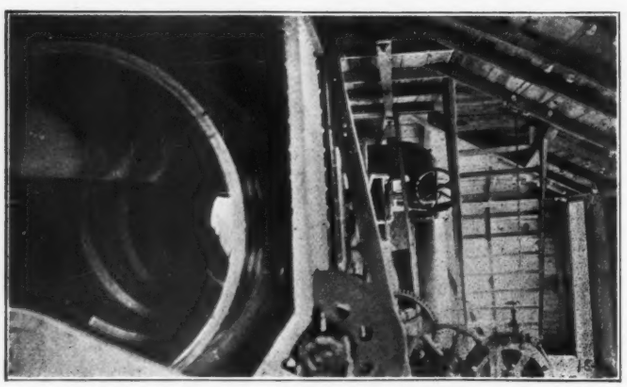
GENERAL VIEW OF THE DREDGE, NEARLY COMPLETED

The upper tumbler is 6-sided, fitted with manganese wear-plates and bearing on a 16-inch nickel steel shaft, the center line being 31 feet above the lower deck. On this shaft is suspended the ladder so that its inclination is constantly the same as that of the chain. On the ladder are 12 steel rollers, 12½ inches diameter.

The lower tumbler is also 6-sided, with face plates and flanges of manganese. It is keyed to a nickel steel shaft, 13¼ inches diameter, the ends of which run in a capped bearing continually filled with oil or grease.

The material excavated is elevated over the upper tumbler, dropped onto a steel dump sheet, where it enters a revolving grizzly, or screen. This screen is of ½-inch boiler plate and is 18 feet 3¼ inches long by 61 inches inside diameter, lined throughout with manganese wear-plates.

There are numerous openings, 4¼x6-inch and 6x7-inch, through which the smaller rocks and finer dirt pass to the sluice box underneath. The grizzly is set flat, but fitted with spiral angles to drive the large sizes to the discharging end, where they are dropped onto inclined chutes that convey them to either side of the dredge. It is also banded near each end



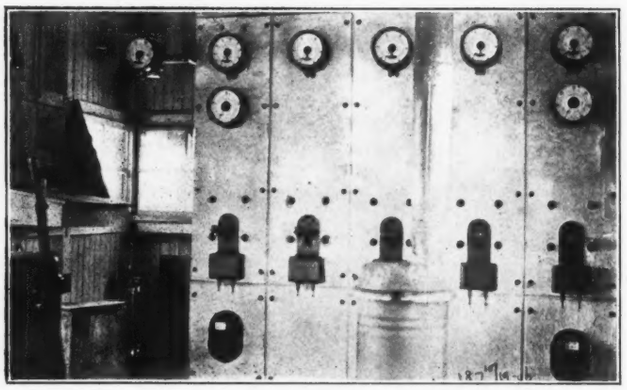
THE BIG GRIZZLY OR REVOLVING ROCK SCREEN.

by a heavy locomotive tire, each resting on and between two manganese car wheels. The shaft on one side also carries a gear, which meshes into the train that is finally moved by a 10-horsepower type "F" Westinghouse induction motor.

The sluice on the upper deck is 28 feet 10 inches long, by 62 inches wide, lined with Hungarian riffles, made up of angles and spring steel liners. The long sluice on a separate pontoon (40x50 feet) is 135 feet long and 66 inches wide, also lined with similar riffles. Near the lower end is a set of closely spaced bars, with an opening in the bottom of the sluice itself, permitting a portion of the finer material to be carried into an undercurrent or auxiliary sluice, 54 feet 6 inches long and 13 inches wide, and lined with wood riffles of the same type. The main long sluice is supported by an angle iron structural trussing, the whole attached to the boat by a steel adjustable tongue, the connection of the sluice itself being circular, with a pure gum packing fitted between specially designed cast rings to prevent leak or spill. The flume is swung side to side in the pond by means of ¾-inch cables, attached on the pontoon to a manually operated double drum winch, and to suitable anchorage on shore.

In the well-way also is provided a set of bars, through which the drippings and sippings from the bucket chain pass to another sluice box at the forward part of the dredge, provided with necessary riffles. The dredge is swung side to side in the pond by means of ¾-inch cables, attached to one end to the forward part of the deck and leading out to a shore sheave, whence they return to the dredge and connect to a reversible, friction type winch propelled by a 10-horsepower type "F" induction motor of Westinghouse make.

The dredge is held to its work by the mooring line system. This consists of a heavy framing at the rear, on which



SWITCHBOARD IN PILOT-HOUSE.

sets the steel mooring head, revolving on a double ball bearing and equipped with four sheaves for the lines. These lines are anchored at the corners of a square, about 600 feet apart. The two forward lines are 1⅜ inches diameter, one end being fastened to the mooring head itself, thence running out to a sheave near the anchorage and returning to pass through the mooring head sheave to a large 4-drum winch on the lower deck. This winch is equipped with the necessary brakes, friction clutches, etc., weighs about 45 tons in all, and is operated by a 30-horsepower type "F" Westinghouse motor. The two stern lines are 1 inch diameter and are fastened on one end to the log anchorage, thence running through the mooring head to the winch.

When the boat is to be moved ahead after a cut has been taken out, the stern lines are slacked off and the head lines pulled in. The latter also serve to hold the buckets to their work, and the system gives an elasticity for hard digging that is not allowed by the spud method.

The power for the digging is transmitted through a specially-built 150-horsepower type "F" Westinghouse induction motor, capable of 100 per cent overload and a stall of three minutes. It is set on a structural strut connecting the mooring head with the bearings of the upper tumbler; it is pinioned to a specially designed Miller Slipping Friction, the 7-inch shaft of which is geared to a 10½-inch shaft, carrying a pinion which meshes into the 13-foot main driving gear on the tumbler shaft. This large gear is of the split hub and drum type and weighs eleven tons. There is also provided an auxiliary brake on the friction shaft.

The ladder is suspended by means of two 1⅛-inch lines, working through a double tackle and connected to a Marion hoist, propelled by a 75-horsepower type "F" Westinghouse induction motor, equipped with magnetic brake.

To wash the gravel there are one 10-inch Worthington Horizontal Volute pump, coupled to a 50-horsepower General Electric motor; one 12-inch Morris Centrifugal pump, coupled to a 50-horsepower type "C" Westinghouse motor; one 14-inch Worthington Horizontal Volute pump, coupled to a 75-horsepower General Electric motor. The total capacity is about 12,500 gallons per minute.

The current is alternating, 60-cycle, 3-phase, transmitted from the power plant on the Madison River, 35 miles at a voltage of 46,000, then stepped down to 2,200 volts for use aboard the dredge. For several of the smaller motors it is then further stepped down to 400 volts, and 110 volts for the lights. The power is brought onto the dredge by means of a heavy insulated cable, 2 inches in diameter, supported across the water on a chain of small pontoons; these latter also serve as a gangway.

In the pilot house are arranged the controllers for the various type "F" motors, in addition to the operating levers, brake wheels, etc. The switchboard consists of five marble panels, equipped with necessary voltage, ampere, kilowatt and recording meters, all of Westinghouse make, and is located in the pilot house.

The dredge has a capacity of about 100,000 yards per month, if not more, when operated continually on the 3-shift basis. It commenced digging on September 12, 1906. The gold is fine, flaky and floury, and it caught by the use of quicksilver freely sprinkled in the sluices.

ALTERNATING-CURRENT NETWORKS.

"The Electrical Review" (London) notes that Signor Grosselin has presented to the International Society of Electricians a communication on "The Factor of Safety Advisable in Connection with Alternating-Current Networks." The surges caused by harmonic resonance may be looked upon as rare, and happen only on networks of small extent; the remedy consists in suppressing the harmonics of the alternators or in checking their effects by the use of limiting devices, in other words, by safety fuses. The perturbations due to closing a switch may cause such disturbance as to double the normal pressure; but in order to do this it would be necessary to have cumulative circumstances, which, fortunately, are rarely met with in practice. It is advisable, however, never to close a switch so that high pressure is thrown on an empty cable; it is far preferable to do this through a rheostat. A less favorable case is that of opening a switch at the far end of the line. The result depends upon the pressure of the current at the moment of breaking, and in this respect it is easy to see that a slow-break switch is preferable to one working at high speed. Short-circuits are the greatest cause of serious disturbance. Atmospheric discharges may also cause serious damage; means should be taken to conduct such discharges to earth through a non-inductive resistance, and the conencting cable should be short and as straight as possible.

HIGH-TENSION LIGHTNING PROTECTION.*

By C. R. M'Kay.

The most serious obstacle to the continuous operation of interurban railroads and transmission plants to-day is the interruption of their high-tension transmission lines and apparatus connected thereto by lightning discharges and disturbances of a similar nature. Interurban railways are naturally more exposed to interruption from lightning than city roads, and since the transmission line links together the entire electrical apparatus of the system, interruptions or damages thereto may, and occasionally do, put the entire road temporarily out of service, and cause heavy loss. Heretofore the protection afforded by any known methods or apparatus has not been wholly satisfactory, either to the operating companies or to the manufacturing companies.

The report of the National Electric Light Association committee on protection from lightning during 1905, which segregates data of high voltage (10,000 and upwards), from low voltage plants, is a long step in the right direction, and furnishes information of a most interesting and practical character. Twenty-nine high-voltage plants reported, aggregating 140,500 kilowatts of capacity. Thirty-eight per cent. of those plants aggregating 60 per cent. of the total capacity suffered serious damage during 1905. Thirty-five per cent. of the total 1,100 miles of transmission line suffered serious interference and but 39 per cent. escaped interruption. Forty-five per cent. of the companies using choke coils suffered serious damage, an equal portion escaping. Thirty-three per cent. of the companies not using choke coils suffered serious damage, 67 per cent. escaping.

The figures as to the use of overhead ground wires for protection of pole lines are not very conclusive. In reply to inquiries as to whether their high-tension arresters were satisfactory, 35 per cent. answered—yes, and 65 per cent answered—no. Of those answering—yes, 78 per cent. had suffered no damage. Of those answering—no, 53 per cent. had suffered serious damage.

The report shows clearly as to high-tension lightning protection that great improvement is still possible in devices for this purpose. It also indicates that the companies reporting on high-tension plants formed their conclusions more largely from the mere absence or occurrence of trouble than from an actual study of the conditions affecting the success or failure of the protective devices. This is but natural and the cause and remedy therefore will be considered later.

To most of us the word "lightning" means a visible discharge of electricity between clouds or between a cloud and the earth. This impression is incomplete and misleading. Dr. C. P. Steinmetz has defined lightning as being any abnormal voltage condition on a transmission line, whether produced by atmospheric electricity or by internal abnormal surges of electricity. Observation shows that the internal conditions of a circuit may be such as to respond, with a dangerous internal surge, to a light harmless inductive stroke from a cloud. Atmospheric electricity may become manifest either in gradual static accumulations, due to wind, rain, induced charges, or a direct stroke. Static induction may charge the line to an abnormal voltage, whether produced by cloud lightning or by the sudden charging of an adjacent line. Surging or the creation of voltage waves of excessive maximum values may be caused by the opening of a switch on a loaded line, by voltage waves of higher frequency than the impressed voltage, by arcs be-

*A paper read before the Central Electric Railway Association, Fort Wayne, Ind., Sept. 27, 1906.

tween the line and isolated conductors, or between one phase and the ground, by short-circuits in transformer or generator coils, or aga'n by the sudden interruption of a short-circuit at the instant of the current wave maximum.

The causes producing abnormal voltage effects in transmission circuits develop many different characteristics of discharge. The discharge may vary in frequency from one thousand cycles per second to one billion cycles per second, according to the time element of the circuit traversed by the discharge and which rarely, if ever, twice has the same constants.

Much laboratory experimenting has been carried out, and much has been learned therefrom, but much must also be learned from experience under actual operating conditions, and that experience hitherto has taught but little because it has not been carefully collected, preserved and delivered to those fitted by training and study for the logical deduction of profitable conclusions therefrom.

There is a large field of investigation in which the operating engineer as well as the manufacturer should work. The laboratory cannot include in its equipment leagues of transmission line, thousands of kilowatts of apparatus, dozens of voltages and frequencies, and real lightning storms with a hundred observers for each.

Among the principal high-tension alternating-current protective devices in present use are overhead grounded wires, series resistances and air gaps with and without resistances.

Grounded Wire.

The advisability of installing overhead grounded wires depends largely upon the particular conditions of each individual system. Opinion is much divided as to their effectiveness, but there seems good reason to believe that when properly installed and frequently grounded they do offer a material degree of protection to the pole line itself as distinguished from the apparatus connected to the transmission line. Its use involves high first cost, and its value would be doubtful in protecting a transmission line constructed upon steel supports properly grounded.

Water Streams.

The series resistance arrester in one prominent form consists of grounded streams of water directed against the transmission wires. This type of arrester seems to have little value in protecting apparatus against high frequency disruptive discharges; it is effective, however, in discharging gradual static accumulations. The stream has variable resistance and presents objectionable inductance to high-frequency discharges.

Air Gap and Resistance Types.

Both abroad and on the Pacific Coast the horn arrester with and without resistance is much used. This type without resistance will maintain an arcing short-circuit lasting several seconds, causing bad line surges and throwing out of step synchronous apparatus connected to the line. When used with series resistance the results are improved, but the use of series resistance offers the serious disadvantage of inability to successfully pass a heavy discharge. Under a light discharge it will generally operate satisfactorily, and by limiting the flow of current will aid in extinguishing the arc across the air gap. Series resistances, furthermore, generally possess considerable impedance, thereby tending to force the discharge across some alternative path with possible resulting damage to apparatus.

The multigap arrester when used without resistance is objectionable in that it offers very little, if any, obstruction to the unlimited passage of current when the arc has been once established across the gaps. The fundamental feature of the present form of multigap arrester is a series of metallic cylinders of less than one inch in diameter placed side by side with spark gaps of about 1-32 inch intervening.

When a shunt resistance is used in conjunction with a series resistance, it is customary to reduce the value of the series resistance and thus detract slightly from the common faults of the multigap series resistance type. For light discharges both the series and shunt resistance will be operative, and for heavy discharges the shunted gaps are automatically cut in. The addition of the shunt resistance does not, as stated above, eliminate entirely the troubles encountered with the plain series resistance. The fact still remains that we have a series resistance, which itself offers considerable opposition to heavy discharges.

In using the shunt resistance without the series the best condition of affairs is approached because all light strokes traverse the shunt resistance, whereas a stroke of large quantity and high frequency will balk at the inductive path afforded by the resistance at high frequency, and will discharge across the shunted gaps. The shunt resistance, if properly adjusted, will extinguish the arc in the shunted gaps and the shunt resistance then acts in series with the series gaps to interrupt the line current. It should be noted that the shunt resistance comes into action only after the lightning stroke is past. Shunting a large percentage of the gaps with just sufficient resistance to prevent excessive current from flowing across the series gaps under ordinary d'scharges, and to serve as a by-pass for the excessive current accompanying a heavy discharge seems to satisfactorily meet the requirements.

A gradual elimination of arrester types proved ineffective by experience under the excessively severe tests of high-voltage transmission has left but two or three types for serious consideration. The multigap type is most generally favored, and nearly all lightning protection for voltages exceeding 600 is effected by devices based upon the multigap principle in combination with resistance. The chief improvement made during the present year in this type of arrester has been the construction and adjustment of the shunt resistance.

In the multiplex arrester a path from line to line is provided with the same number and arrangement of gaps and resistances as from line to ground. Observations made to determine the advantage of the multiplex connection show that frequently the high potential disturbances pass from line to line across the multiplex connection, thus equalizing abnormal strains between lines, without traversing the gaps to ground. In circuits having considerable resonance it is sometimes necessary to increase the number of gaps between line and line to reduce the danger of an arc forming and holding over the line gaps.

The design of the multigap arrester without series resistance fulfills all laboratory requirements, and provides greater security under operating conditions than previous types. It protects from minor static disturbances, as well as being always ready for the severest surge or external stroke, and approaches a practical solution of the lightning and static strain problems which now influence long-distance transmission systems.

Ground Wires.

It is pertinent to refer to the grounding of protective apparatus, although in recent years much improvement has been made in this direction. Its importance is being more generally realized, but there are many plants wherein the weak link in the lightning protection is found between the visible portions of the "ground circuit" and the earth itself.

Wherever possible the ground wire should be straight, and, therefore, the ground itself should be directly under the lightning arrester. In designing a new power station this condition can generally be made possible, and care should be taken to do so. In older stations with grounds already installed at some distance from the arrester it is advisable

to make an auxiliary earth connection as nearly beneath the arrester as possible. This is advisable even though the resistance of this auxiliary earth may considerably exceed that of the main earth. The ground wire should be attached to a copper plate having an area of at least four square feet, embedded in charcoal or coke and surrounded by moist earth. The earth surrounding the pit containing the coke can be kept moist by embedding a vertical perforated iron pipe in the coke. The ground wire may run down the side of this iron pipe and the plate may consist of a copper strip about six inches wide and as long as convenient bent lengthwise around the pipe. Either ground wire or plate may be soldered to the iron pipe. Water can both drain and be poured into the perforated pipe, and will percolate through the soil and coke, keeping the "ground" perfect under most adverse circumstances.

Data Regarding Performance.

Generally speaking, we lack conclusive data showing the specific values of various high-tension protective devices, the causes of failures, the relative liability to trouble with various voltages, frequencies, topographies and methods of construction. More particularly is our knowledge limited as to what actually occurs, where and when a lightning disturbance takes place. We must thoroughly understand the nature of the disease before we can cure it.

The manufacturer seeking among operators for accurate information on these matters finds it almost impossible to obtain consistent or valuable statements. Different operators utilizing identical protective apparatus under apparently similar conditions give wholly contradictory reports regarding their effectiveness. Companies having the least trouble frequently assume that they have the best protection. No assumption could be less justified. The remedy for this condition lies chiefly in the hands of the operating staffs of the stations and the transmission lines.

It cannot be questioned that the existing lack of practical data covering these matters has been due to the failure of the operating companies to record and preserve it, and this failure is doubtless due largely to a lack of understanding on the part of operators and their employes as to just what information is requisite and valuable. It is hardly conceivable that operators would be so blind to their own interests as to neglect this question, were they fully posted as to the character of information required and the ease of obtaining it. The labor involved in taking and recording the necessary observations is negligible, and technical knowledge is unnecessary. What is wanted are certain facts visible to the operating employes of stations and lines. These men are the ones who see the phenomena at first hand and the men first on the spot after a breakdown, and it is only through the data thereby obtained that a true conception can be obtained of the nature of the discharge and the causes of such failures as occur.

The importance of getting the information immediately at first hand in some suitable shape for future tabulation should be clearly realized. It is desirable and essential to distinguish between the actual observations and the conclusions that may be drawn from these observations; in their relative importance detailed evidence stands first, opinion second.

The universal adoption and use by the members of the Central Electric Railway Association of a suitable information blank covering the nature of each disturbance witnessed would, when answered, compiled and tabulated into a suitable report, provide a vast quantity of data immediately useful in determining the best method of installation and the most suitable device to meet the conditions of any particular system. The use of telltale papers, properly located in the arresters and perhaps operating with a time movement, will be of great value in connection with the other observations, especially in furnishing some record of occurrences taking place in too rapid sequence for the eye and brain to catch and note them. In no other manner can so much valuable information on the subject be so quickly obtained and so effectively utilized. The advantage of the method lies in speedily securing a large amount of practical information with correspondingly quick benefits by the elimination of devices proved ineffective and by materially aiding the improvement of existing devices and the production of new and thoroughly efficient ones.

The class of information which is important to obtain includes details of the following:

A description of the system covering its general arrangement, its geographical and topographical features; station apparatus, power lines, protective apparatus, character of apparatus protected, character of operating mechanisms, observations of the discharge, location of discharge and accompanying phenomena.

A committee has been appointed by this association for the express purpose of providing the members and their employes with specific information as to the data necessary to make an intelligent report of lightning and similar disturbances, and to provide an information blank for continual use by employes during the coming season in recording occurrences of the kind under consideration. The committee will classify and summarize the reports, placing the resulting data freely before the members of the association and the manufacturers of protective apparatus. The manufacturers may then utilize this data toward the improvement of their protective devices.

The success of this movement is wholly dependent upon your individual efforts in executing the committee's program. If you respond as your interests demand, you will promptly reap the benefits, otherwise it cannot reasonably be expected that the manufacturers will, without the benefits of your experience, produce for you as satisfactory results as you demand and expect of them.

ELECTRICAL FRAUDS.

With reference to the protection of investors from the solicitations of unscrupulous promoters, the November "Proceedings of the American Institute of Electrical Engineers" contained the following:

"Within a few weeks letters have been received by the Secretary from members in different parts of the country, calling his attention to the exploitation of so-called wonderful electrical inventions. In all cases opportunities for investment accompany such publications. The chief exploiter in one instance has served time in the Michigan state prison. In another instance the young man who figured as an electrical engineer in connection with the device was warned months ago that he was engaged in a disreputable enterprise from which he should withdraw if he had any regard for his engineering record.

"The wish has been expressed by some of our members that the Institute could do something to expose these schemes. This appears to be impossible. It would be impractical to reach, and even then to convince, the susceptible victims of the character of these schemes. We have unusual facilities for giving private information to our members in some cases, but there can be no improvement upon the ancient proverb: 'Let the buyer beware.'

"The electrical field is peculiarly favorable for giving an apparent basis to these claims of vast financial possibilities, as people generally have little knowledge of the facts, so that after all the proportion of successful adventurers in this line appears to be remarkably small."

THE EFFECTS OF HIGH PRESSURE UPON ILLUMINATING GAS.*

By E. C. Jones.

In order to determine the results of compression upon the chemical and physical properties of illuminating gas, the writer used a portable gas compressor operated by a gasoline engine. The first stage compressor effects compression up to 100 lbs. and delivers the gas into a steel tank 5 ft. long, 12 inches diameter, furnished with a gauge and an outlet leading into a second stage compressor capable of raising the pressure to 300 lbs., and in its turn delivering the gas into another horizontal tank 6 ft. long and 10 inches diameter, also supplied with a gauge.

The second stage compressor was especially designed for this work, and consists of two tandem differential cylinders, the larger of which is operated by gas pressure at 100 lbs. from the first stage compression tank, and raises the pressure by operating the piston in the smaller cylinder. The apparatus might be termed a gas ram.

From the second stage compression tank the gas was admitted to an upright galvanized iron house boiler 5 ft. long by 11 inches in diameter, fitted with a gauge and blow off valve. This boiler communicates directly with a bar photometer.

The gas used for these experiments was what is known as crude oil water gas of 21.6 candle power. This gas is made from 14 deg. baume, California crude petroleum, without the use of solid carbon in any form. It is a well fixed gas, and is used for all purposes throughout the Pacific Coast, and with the exception that it has a higher percentage of illuminants, it resembles coal gas so closely that it might almost be called an artificial coal gas. Its specific gravity was 0.413, and it contained 626 British thermal units per cubic foot.

The experiments were made with unpurified gas, which analyzed as follows:

	Per cent.
Illuminants	7.00
Marsh Gas	29.7
Hydrogen	50.0
Carbon Monoxide	5.2
Carbonic Acid	3.0
Oxygen	Trace
Nitrogen	5.1
	100.00

A successive series of compressions was made with an increase of 30 lbs. at each compression. Fresh samples of gas were used in every case; that is, gas that had been once compressed was not used again in any succeeding compression.

The most remarkable effects of compression are the continuous reduction of the candle power and the elimination of naphthalene and sulphuretted hydrogen. From a candle-power of 21.6 the gas dropped to 17 candles at 60 lbs.; to 11.1 candles at 180 lbs., and to 5.5 candles at 300 lbs. The crude gas contained 200 grains of sulphuretted hydrogen per 100 cu. ft., while the 300 lb. gas contained no sulphuretted hydrogen.

The appearance of the flame of the compressed gas is very deceptive. It looks fair, and to the naked eye its color is unchanged. When compared with standard candles its richness is seen to have gone, and when observed through the spectroscope, the yellow portion of the spectrum has narrowed and the blue and green increased.

The next point of interest was whether the liquid compression product could be reintroduced into the compressed gas upon releasing the pressure. The 300 lbs. gas was brought into contact with the compression liquid, and the candle-power rose from 5.5 to 29.3 candle-power. To enrich this compressed gas it is not necessary to scrub it with compression liquor. It is required only that the gas should pass over the surface of the liquor.

The most important point of all, when the condensed illuminants were restored to the gas, it was discovered that the sulphuretted hydrogen did not again appear in the gas. The explanation of this, I believe, is that the sulphuretted hydrogen, on leaving the gas, combines chemically with some of the hydrocarbons to form an organic sulphide of mercaptan.

In support of this, the compression liquid gives no test for sulphuretted hydrogen with lead acetate, and if the liquid is distilled, the hydrogen sulphide does not appear until near the last fraction, where all the sulphuretted hydrogen and naphthalene appear. This fraction given an immediate test for sulphur with lead acetate, showing that the heat has dissociated the sulphuretted hydrogen from some other compounds. Moreover, if sulphuretted hydrogen made in the laboratory be dissolved in the compression liquid, that liquid will then give the lead test for sulphur, and heating will drive off all the sulphuretted hydrogen so dissolved before the first fraction has come off. Such liquor will also foul pure gas.

A later series of tests shown in the second table confirm the results of the first series.

The crude gas contained 260 grains of sulphuretted hydrogen, and when compressed to 120 lbs. the gas only contained 70 grains, and the gas at 300 lbs. pressure contained no sulphuretted hydrogen.

The greatest loss of candle-power was between 60 and 90 lbs., while in the previous series it was between 30 and 60 lbs. This may be explained by the fact that the candle-power of the first gas was higher than the second, and had not the stability, its additional candle-power being derived from illuminants more easily removed by compression.

The writer is familiar with the many experiments heretofore made to determine the effects of compression upon the candle-power of illuminating gas, and has had experience in the compression of large quantities of gas commercially to supply the various high pressure system in California. The writer has also become aware of the great difficulty of ascertaining the actual damage done to the gas by compression, on account of the avidity—one might say thirst—with which the gas reunites with its condensed hydrocarbons.

In the foregoing series of experiments, great care was taken to use fresh samples of gas and to remove every trace of condensed liquor before each experiment.

In many high pressure systems, where no condensed liquor is drawn off, no loss in candle-power is observed. It has, therefore, been taken for granted that no reduction in candle-power occurred.

The writer uses, in connection with all high pressure systems under his care, a simple re-enriching tank, through which all the compressed gas finally passes before going into the main pipes. This is called an "auto-enricher," on account of its simplicity and self operation. It consists of a compression tank placed horizontally with an inlet at the top of one end and an outlet at the other top at the end. This compression tank is placed at the outlet of any other storage compression tanks there may be in the system, and all gas as well as all compression liquor must pass through this tank. No compression liquor is drawn away, and the mere contact of the compressed gas with the liquor satisfies the lack of hydrocarbons and restores the gas to its normal candle-power. This is proven in practice in many large systems every day, and one of its strange features is that there is no over or under enrichment of the gas.

To sum up the results of these experiments, we find that the compression of gas removes sulphuretted hydrogen and naphthalene, and if the compression is carried as high as 300 lbs. per square inch, purification in gas works may be dispensed with.

*Presented at the first annual meeting of the American Gas Institute, held in Chicago, October, 1906. Mr. Jones is at the head of the Gas Department of the California Gas and Electric Corporation.

densed hydrocarbons are kept in contact with it, and to demonstrate the actual effects of high compression upon the gas, it became necessary to exert great care that the results should not be misleading, because of the ease with which the gas takes up condensed hydrocarbons and resumes its normal candle-power.

The compressed gas, besides being freed from sulphur impurities, contains no naphthalene, and while this is recognized as a valuable illuminant, its value is more than offset by the troubles it causes.

The gas is not damaged in illuminating value if the con-

The purification of gas by compression is ideal, as it is continuous and cleanly, requires no purifying material, nor expensive and cumbersome purifiers.

After each compression an analysis and a photometer test were made, and the results tabulated as follows:

TABLE 1—THE EFFECTS OF HIGH PRESSURE UPON ILLUMINATING GAS—APRIL 12, 1905

Pounds	C_nH_{2n}	CH_4	H_2	CO	CO_2	O_2	N_2	Sp. gr.	B. t. u.	C. p.	
0	7.0	29.7	50.0	5.2	3.0	Tr.	5.1	0.413	626	21.6	H_2S, 200 Grains
30	6.8	29.8	50.1	5.4	2.8	Tr.	5.1	0.411	625	20.0	
60	6.8	29.6	50.2	5.5	3.1	0.1	4.7	0.412	624	17.0	
90	6.8	29.6	50.3	5.5	3.1	Tr.	4.7	0.411	624	16.0	
120	6.7	29.5	49.2	5.6	3.2	0.1	5.7	0.422	618	15.0	
150	6.7	28.8	51.3	5.5	3.3	0.1	4.3	0.407	617	14.0	
180	6.5	29.0	51.0	5.5	3.0	Tr.	5.0	0.407	615	11.1	
210	6.0	29.0	51.0	5.7	3.2	0.1	5.0	0.408	607	9.6	
240	6.3	29.0	51.0	5.4	3.2	0.1	5.0	0.408	611	10.8	
270	6.0	29.1	51.6	5.5	3.2	0.1	4.5	0.403	610	6.2	
300	5.7	30.0	51.4	5.6	3.0	0.1	4.2	0.399	614	5.5	H_2S, None

TABLE II—THE EFFECTS OF HIGH PRESSURE UPON ILLUMINATING GAS—SEPT. 8, 1906

Pounds	$C_n H_{2n}$	CH_4	H_2	CO	CO_2	O_2	N_2	Sp. gr.	B. t. u.	C. p.	
0	8.4	27.5	50.3	5.0	4.0	0.2	4.6	0.425	653	20.9	H_2S, 260 Grains
30	8.3	24.8	54.1	5.0	4.0	0.2	3.6	0.402	635	20.8	
60	6.0	23.6	55.5	6.8	3.8	0.2	4.1	0.393	587	17.6	
90	6.2	26.2	53.3	5.0	3.6	0.2	5.5	0.401	606	11.5	
120	6.4	24.0	55.6	5.0	3.6	0.2	5.2	0.390	594	11.1	H_2S, 70 Grains
150	6.2	21.2	61.5	5.0	3.6	0.3	2.2	0.348	580	9.7	
180	5.8	24.4	57.3	4.8	3.2	0.2	4.3	0.371	591	8.6	
210	5.7	22.9	60.2	5.0	3.1	0.2	2.9	0.349	584	7.2	
240	5.4	23.0	59.4	5.0	3.1	0.3	3.8	0.357	576	6.5	
270	5.6	22.2	60.2	5.2	3.0	0.2	3.6	0.352	575	5.8	
300	6.2	22.8	58.0	4.8	3.2	0.2	4.8	0.371	585	4.7	H_2S, None

DURATION OF FLASHES OF LIGHTNING.

We possess as yet only pretty vague data as to the average duration of flashes of lightning, says "L'Illustration." Farady thought he could fix it at a second. Dufour claimed that the flashes of lightning were instantaneous, and that their rapid succession gave the illusion of one flash of a certain duration. Herr Schmidt has been devoting himself to a series of observations, employing a disk of ten centimeters diameter bearing upon a black ground a white cross, the arms of which were two millimeters across, the disk being set in motion by clockwork with a speed of 50 to 60 revolutions a second. At certain flashes, the cross appeared a single time, very distinct; the duration of lightning was, therefore, inferior to the time of revolution of the disk, which would represent about the fiftieth of a second. In more numerous cases, the cross appeared two or three times, or even more, but with a decreasing luminous intensity; the lightning had, therefore, lasted during several revolutions of the disk.

The "Gas World" notes that Professor Haber has constructed an instrument for studying the composition of a gas by finding its index of refraction. With this the amount of carbonic acid in products of combustion can be ascertained within 0.12 to 0.10 per cent by reading off the apparent position of an image thrown upon a scale. The apparatus is equally sensitive for methane, hydrogen, hydrochloric acid gas, and hydrocyanic acid; while for sulphurous acid, sulphuretted hydrogen, chlorine, acetylene, ethylene, benzol, and pentane, it is from two to ten times more sensitive.

Professor Goss of the University of Purdue has made some experiments toward determining the efficiency of flake graphite lubrication as compared with that of neat kerosene lubrication. The addition of one part by weight of flake graphite to two parts of kerosene permitted an increase of load from 50 pounds per square inch of projected area to 110 pounds, and decreased the co-efficient of friction from .00547 to .00296. A later experiment on the same journal with kerosene alone, after the rubbing surface had been well cleaned, gave excellent results, but this was probably due to the persistence of graphite in the microscopic pores of the bearing surfaces.

WOODEN FLYWHEELS.

After an accident to a flywheel in a large European electric station the superintendent designed and had constructed a flywheel of wood which has a diameter of over 35 feet, and a rim width of 10 feet.. The thickness of the rim is about 12 inches, and it is made up of 44 thicknesses of beech planks, with staggered joints. The boards were glued together and then bolted. The inside consists of a double wheel, the 24 spokes of which are fastened to two hubs. Spokes and hubs are of cast iron. The wheel is operated at 76 revolutions per minute, which corresponds to a peripheral speed at the rim of 130 feet per second (94 miles per hour). This is said to constitute a record for wooden flywheels.—Power.

FRENCH INGENUITY.

A French inventor seems unusually prolific in adapting the gasoline engine to novel uses. Some time ago he applied small engines to a so-called "skate," which consisted of a wheel about 10 or 12 inches in diameter, the device being attached to each boot of the wearer and propelled by a gasoline engine. A storage tank is located on the shoulders of the person using the skate. Now he has invented a waterproof casing containing a gasoline engine and its fittings, with a screw propellor operated by the engine. The whole device is strapped to the back of a swimmer, who sits vertically in the water on a seat projecting from the front of the mechanism, and the engine is used as a means of swimming. Air bags are used as floats. One service claimed for the device is its adaptability to life-saving work.—The Gas Engine.

ORGANIZATION AND CONDUCT OF A NEW BUSINESS DEPARTMENT SUITABLE FOR CENTRAL STATIONS IN CITIES OF FIFTY THOUSAND POPULATION AND UNDER.*

By Fred. D. Sampson.

The unquestionable success of the pioneers in many gigantic business enterprises in this country causes the thoughtful to wonder at the almost insurmountable obstacles these foresighted "Kings of Commerce" must have encountered in the development and perfection of these mammoth institutions.

In what manner were these great commercial feats carried out? By efficient organization and its indispensable attributes, initiative and action.

The ultimate results accomplished proved that their methods must have been the correct ones. Their dealings with the public laid a foundation of unbroken confidence.

The development of these commercial enterprises was the outcome of years of perseverance and courage upon the part of the promoters. Prejudice had to be overcome, suspicion allayed by the selling organization of these successful founders.

The Central Station management in the past for the promotion of new business, has been in the hands of technical graduates with few exceptions. Men thoroughly versed in the electrical and mechanical performance of the properties were under their direct supervision.

The sale of electricity is a commercial problem, not an electrical one.

The introduction of simple, direct advertising methods will accomplish the same results for the promotion of additional business to the central station in the future as these essential methods have done for the mercantile supremacy of this country in the past.

The new business department of a central station will be the chief factor in the growth of the sales of electricity in the future—supplemented only by the quality of the service furnished.

The Organization.

The executive head of this department will be known as the Sales Manager, who shall have direct supervision of the sales of electricity—the sales force and the advertising.

This position is one of the greatest importance and responsibility, and upon the sales manager devolves the success of the entire venture; he is the "business getter"—the life of the entire department.

The organization must be imbued with the spirit of co-ordination; the exemplification of which must be the head of this department; he must be the spirit of enthusiasm; his executive ability paramount in the training and conduct of the sales force.

The sales force, or solicitors, shall comprise young men preferably with college educational training, of local social connection (the personal element is quite a potent factor in the solicitation and promotion of business).

The young men should understand the technical talking points of the product they expect to sell,—its multiplicity of uses,—the approximate consumption of energy in the application of electrical apparatus that may be connected to the company's mains. There are always to be found in the cities of this class, young men with technical training who have been apprenticed to some of the large manufacturing concerns, anxious to obtain the opportunity of furthering their experience by entering the service of a central station organization. Young men of this character would prove invaluable in this department, for the reason that their electrical training would make them familiar from the start with the technical features of the subject; and, furthermore, with factory or shop experience they would be versed in the actual construction and performance of all classes of electrical apparatus, filling the dual position of salesman and engineer. In addition to the technical sales force, a young man would be employed for the clerical work in the office (some stenographic experience would be necessary in this position). With the increasing volume of correspondence a young woman stenographer could be added.

The Conduct.

Good advertising is a special appeal. It creates a special interest in what you desire to advertise.

Adherents to a single medium of advertising results in indifference; acute interest is only awakened by demonstration; the public is always ready for a novelty.

We should open the campaign with a direct appeal in the form of a return postal card to every desirable householder; names of such can be obtained in telephone and city directories, both of which give full address and occupation (information difficult to get through other sources and tedious to complete). Thus a complete alphabetical arrangement of proposed customers is procured in the simplest of manner. The postal cards would carry the name and address of the person to whom sent. Upon the reverse side printed in an attractive way, "Please answer accompanying question." "Sign your name in full and return." Printing upon return cards would read "Sales Manager," "New Business Department, City." Upon the reverse portion such questions as the department desired answered by party addressed, together with room for signature. The return portion of these cards could also be enclosed with circular letters and other forms of literature when answers were desired, the card thus serving a double purpose.

Using a card system, the name of each person with address, date and kind of literature mailed would be filed alphabetically. Sufficient information could be kept upon this card to arrive at the exact status of each person addressed, whether promising or not. This card for filing would be made out simultaneously with the first edition of mail matter sent. In this manner a complete record could be kept. The sales manager and sales force would all familiarize themselves with the mailing list. The city divided into districts could be canvassed by the technical sales force directly following inquiries, or at regular intervals.

A circular letter could be made very effective, embracing one specific each month. Plain, lucid phraseology, with practical facts, should be the essence of these letters, especially in the case of letters to contemplated power users. Experience will demonstrate that this class of service is the more difficult to secure on account of false impressions as to the economics of operating costs. These letters should be followed by visits from solicitors and later by sales manager.

Newspaper advertising is too costly to be used in addressing a class; it should be a non-partisan medium to secure the attention of the masses. Properly carried out this form of advertising is of the best. The people of more leisure read both morning and evening papers. The larger majority of possible consumers read the evening papers on account of their occupation during the day, hence advertisements should be maintained in both papers. Furthermore, the newspaper management points with pride to its progressive advertisers, reference being made in local columns in direct ratio to the expansiveness of the advertisement inserted.

The language of the advertisement should be of the choicest. "Slang" holds the attention of nobody.

*(**Editor's Note:**—This is the last of the papers on the Organization and Conduct of a New Business Department for Central Stations, issued by the Co-operative Electrical Development Association.)

Illustrated advertisements could be used occasionally as a divertisement to the usual form. The newspaper advertising would be under the supervision of the sales manager, and the forms should be changed two times per week.

The many forms of monthly bulletins or electric service booklets, illustrated, are probably the nearest approach to the ideal advertising that has been devised.

These attractively worded and illustrated bulletins are more generally commented upon when sent through the mail than any other form of advertising; they are really works of art. Distributing by mail is a great advantage over the house to house or hand distribution—a much larger proportion reaching their destination by this method of delivery. The bulletins also escape the association with the "patent medicine" and "fire sale" literature.

A complete mailing list of bulletins should be kept on filing card, in the same manner as for other literature.

Another form of illustrated advertising is that of the printed matter circulated free to central stations by the manufacturing companies introducing their many small electrical specialties, such as fans of all kinds, small motors for household uses, heating apparatus, special forms of incandescent lamps, Holophane glass ware, shades, etc. These can all be had for the mere asking, and could be added to the mailing list to be sent at regular intervals.

Street car advertising has not been extensively exploited, however, it would doubtless prove an estimable addition to the various systems of advertising inaugurated.

There is one uncontroverted fact; street car advertisements are always before you; you cannot get away from them. Another indisputable advantage is that of the excellent system displayed in the care and frequent change of these advertising cards. A point might arise in case the street car and the central station systems were not conjointly owned, whether this form of advertising could be adopted; especially if the street car and the gas companies were owned by the same concern.

The display feature as an incentive to the increased and more general use of electricity is probably the most effective form of advertising in vogue.

There are many ways to advantageously display the innumerable uses to which electricity can be put. A large, attractive sign in front of the central station offices bearing the inscription "New Business Department," operated every night would create public interest, both in the sign and in the department. A display room could be opened in connection with the general offices of the central station, where the various forms of lighting and lamps of different candlepower could be connected to circuits controlled by switches, to demonstrate to proposed customers the elementary control of electric lighting. In this connection, instructions in the reading of meters could be given by the sales force at opportune times.

An innovation could be introduced whereby all electrical contractors of unquestionable financial responsibility in the city would be furnished current free; provided that they would carry a line of electrical specialties for lighting, power and some heating, and display same in prominent location. This would be of mutual benefit and limit the quantity of display apparatus carried by the central station.

It would not be irrevelant to remark that the less stock in direct competition with the electrical contractor—the central station carried, the more business it will do with correspondingly less outlay.

The duties of the staff of the new business department would be in a measure dependent upon the urgency of the specific cases requiring its attention. The routine or regular work would comprise a consultation each morning with the sales manager and unfinished business discussed and future work planned. For the convenience of the assistants the business and residence districts could be reduced to a map in sections, printed on public service cards, shaded by solicitor to represent territory covered each day with an epitome of results noted on reverse side. Thus the area canvassed at any specified time could be ascertained at a glance. Upon the receipt of inquiries by mail or otherwise, the acknowledgment of same would be made, stating time representatives could call for interview. Complete details of result of interview recorded, as nearly as possible, same being filed in office under proper classification as to person, address and class of service contemplated. Records of this kind under the present system of public service cards are invaluable for reference, a single kilowatt is higher than in other classes of lighting. There is also a growing demand for special devices for lighting, heating and cooking, where social functions enter into the question.

Church lighting is very desirable aside from its pecuniary advantages, also by the influence it might exert among those not easily reached by other channels of advertising.

These subjects pro and con must be considered as vital statistics in conjunction with the duties of the soliciting of new business.

The relationship of the new business department to the operating management should be that of the department coming under the direct supervision of the manager of the central station.

The sales manager would be directly responsible to the manager of the company.

In all matters pertaining to the conduct and operation of this department, the sales manager would be the executive head.

Contracts made by this department would be subject to the approval of the proper authority of the company—countersigned, however, by the sales manager.

All employees of this department should be placed upon a salary basis, commensurate with their worth and to the locality. Commissions might be considered, although the equity of same is very questionable, unless solicitors were changed from time to time to equalize the advantages of canvassing in power districts.

It must be admitted that upon the general conduct of office men being able to manipulate a vast amount of business with correctness and dispatch. The solicitors would refer to these files for information, not having to rely solely upon memory or memoranda.

Information regarding the operation of manufacturing enterprises using coal, gas, or other fuels should be carefully listed, statistics governing each properly compiled. Owners should be interested with the importance and economy of electric drive, the indisputable points emphasized. The necessity of indicating the horsepower of the prime movers, both with and without load, must be established without contradiction; herein lies the secret of the failure in many cases to convince possible customers to the adoption of electric power. The customer argues on the basis of capacity; load factor, through ignorance, being ignored. Demonstration here plays an important role. The solicitor must court the occasion to make a success.

An error easily comprehended has been committed in the mediocre solicitation of business in the past by the declination of certain classes of service. This is a mistake, especially in reference to residence and church lighting. In the first place a well-pleased customer is the best of advertisement. Secondly, the residence lighting load is carried through a larger total number of hours per annum, especially since early closing has been established in stores and business houses. The outlay per kilowatt in apparatus is less in residence lighting. Furthermore, the net rate per annum in this department has in it the success of the company.

The policy followed must be without reproach. The methods above suspicion.

To the employees "courtesy and attention to every one all the time." Avoid extremes; don't exaggerate. Patriotism and perseverance for the company.

The JOURNAL of ELECTRICITY POWER AND GAS
NOW INCORPORATED
Engineers' Architects and Builders' News

Published Weekly by

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304 Atlas Building, San Francisco.

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EASTERN AGENCIES

NEW YORK.....
CHICAGO.....
ST. LOUIS.....

WESTERN AGENCIES:

LOS ANGELES.....
PORTLAND.....
SEATTLE.....

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers' Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XVII DEC. 29, 1906 No. 26

EDITORIAL.

Power in the West.

The great manufacturing centers of the United States are all to be found east of the Missouri River. For almost all articles requiring any considerable quantities of raw material, and in the making of which labor and power are important items, the West has been, and probably for some time will continue to be, largely dependent upon the East.

The output of the mines, vineyards and ranches of the West tend to balance the scales to some extent, but to build up an independent and considerable population in the West, more manufacturing must be done, and the product either used locally or sent to the Orient.

The cost of labor, raw material and power should all be reduced before manufacturing in the West can materially compete with corresponding interests in the East. The cost of the necessary raw material is a matter which can only be affected by modifying the cost of transportation from the East in the majority of instances. The question of the cost of labor is one which will probably adjust itself as conditions become more uniform as regards the cost of living East and West.

It is of the greatest importance, however, for the future of the manufacturing interests of the West that the cost of power may be as small as possible. Until the development of the oil fields of California, which produce great quantities of crude petroleum, the cost of fuel in the form of coal or wood was so great as to practically prohibit manufacturing of any character in the West where the quantity of power needed was of material consequence.

The amount of fuel oil transported by the railroads has been so great as to cause a most serious shortage of cars and rolling stock, thereby not only increasing the cost of fuel oil but on occasions diminishing the available supply, making the situation most serious fo rpower plants and large users of oil for fuel. This condition has been somewhat improved by the building of oil pipe lines, but even with the improved conditions, the cost of fuel oil would undoubtedly be quite a little larger than it is, were it not for the utilization of water power in connection with long distance electric power transmission.

Fuel oil and water are today the cheapest sources for generating power in the West. Where transportation charges are not excessive, power may be generated from fuel oil at a total cost considerably less than the same quantity of power coudl be delivered from a water power system using electric transmission. There are, on the other hand, however, a great many instances, particularly where power is used for mining or dredging, where the cost of transportation makes it impossible to use fuel oil for producing steam power. The wise and economical joint use of water power and oil fuel has resulted in very materially improving the situation and encouraging manufacturing industries as a result of the reduced cost of power.

It is probable that the available suppyl of fuel oil, while of great extent, is at best limited. The present cost of this fuel is much less than the former cost of coal. How long such a condition wil continue is, however, a question. Therefore, the desirability of developing all the available water powers of the West as rapidly as possible cannot be questioned, and every State in the West, and particularly on the Pacific Coast, should stand together and insist that each State, as well as the National Government, both do all within their power to encourage the construction of water power electric transmission systems.

MAGAZINE NOTES.

The December number of the "California Journal of Technology,, contains some interesting and instructive articles on widely different subjects, varying from "The Value of Brick in Concrete," by Loren E. Hunt, to "Recent Methods in Wireless Telegraphy," by T. C. McKay. Roland L. Oliver discusses the use of detonating caps in blasting, and R. T. Crawford gives some hints on practical computing for engineers. The Steffens process for separating sugar is described by Robert T. Pike, and the copper country of Northern Michigan by A. A. Wheelock. The second half of a lecture on fluid apparatus, delivered at the University of California, by John Richards, is also contained in this number.

The "Travel Magazine," for January, is to be primarily a California number, since it is to contain articles descriptive of the State, its delightful climate, its enchanting scenery, its fertility, and its characteristic architecture. Some of the contributors will be French Strother, Helen Lukens, Gaut, Sarah Comstock, Percy K. Crocker, Jane Dudley, Warwick Stevens Carpenter, Anna McClure Sholl, and George R. King.

TRADE CATALOGUES.

A catalogue of lighting specialties manufactured by the well-known firm of Harvey Hubbel, Inc., Bridgeport, Conn., is being distributed by the Los Angeles office of the California Electric Company and the Seattle office of the Western Electric Company.

PERSONAL.

Mr. C. Remschel, who is connected with the sales department of the Allis-Chalmers Company at Seattle, has joined the list of benedicts. He was married on December 26th. Mr. Remschel's address is Box 1573, Seattle, Wash.

Mr. Thomas F. Delury has entered upon his duties as Oakland manager for the Sunset Telephone & Telegraph Company. Mr. Delury has been connected with the Sunset Company for fourteen years.

TORSION IN ENGINE SHAFTS.

The fluctuation of the turning effort of pulleys driven by reciprocating engines causes a corresponding variation in the angle of twist of the shafting. This, though not perceptible to the eye, is accompanied by a rapidly changing internal stress which is undesirable. "The Engineering Times" recently points out that the subject of torsional vibration of shafting has received very careful attention in Germany, and the types of torsion meter employed by Fram and Foettinger have been specially designed to secure definite records of this fluctuation of stress, as opposed to the Denny Johnston meter, from which only the mean torque can be read; the German methods involve greater complication, but suggest some important possibilities in design. The distance between the engine and propeller is generally considerable, and the shaft, therefore, should not be regarded as rigid, but rather as a torsional spring, more or less elastic according to its proportions, which is kept under stress by the opposite couples at its ends. With the engine running perfectly uniform, as in the case of a turbine against a constant resistance, the shaft would undergo a constant stress, and the torsion would therefore be constant also, but with the fluctuation in turning moment due to pressure and weight of reciprocating parts, the torsion due to the engine is far from constant. Moreover, the inevitable fluctuation in resistance at the other end of the shaft increases the oscillatory nature of the stress, and the shaft is therefore subject to torsional vibration of a very irregular and complex character. Consequently the arc of torsion is continually varying, and the shaft even in the best (so-called) balanced engine is in a state of violent vibration, which, though it may easily escape the eye of an observer, is yet instantly detected by either of the German types of indicator. To emphasize the degree of this vibration it has been proved by measurements made by Frahm and Foettinger quite independently, one with an electrical indicator, the other with his mechanical type, that the arc of torsion is even occasionally negative.

In the Foettinger meter a disc is fixed direct to the shaft in a convenient place, while a few inches from it is a second disc carried on a tube concentric with the shaft and as long as convenience permits. These discs perform practically the same functions as those in the Denny-Johnston meter; that is, the arc of torsion on the circumference of the shaft is but small, but carried out to the circumference of the discs is magnified in proportion. Mechanism is so arranged between the two discs that their relative movement is reproduced and magnified by the same kind of pencil arrangement that is found in ordinary steam indicators. The paper carrying the drum is also concentric with the shaft, but is placed on the other side of the fixed disc to that of the tube. The diagram is taken in the usual way. From these diagrams may be worked out the effective torque curve at any point in the revolution, and thereby the brake horsepower or torsional horsepower determined.

GAS TURBINES.

Among the prime movers of the future, the gas turbine is likely to rank with others now commercially practical or nearly so. The gas turbine is still in the experimental stage, and, as Mr. E. M. Speakman pointed out in a paper recently read before the Institution of Engineers and Shipbuilders in Scotland, no very great development can be expected until many difficulties have been overcome. One of the most troublesome of these is the very great velocity of rotation due to the high speed of the gas during explosions. A large part of the work done by the turbine is now used up in compressing the gases, so that the output is not a large percentage of the work actually done. Probably the most serious drawback is the low efficiency produced by the rejection of a large amount of heat. This is necessary to keep the temperature down, since a high temperature results in a rapid disintegration of blades and nozzles.

A DYNAMOMETER FOR SMALL MOTORS.

A report was submitted recently by Georg Nicolaus to the telegraph section of the Elektrotechnischen Verein, dealing with the testing of small motors such as are used in telegraph and other similar work. The dynamometer is of the air-vane type, and consists simply of a split sleeve which may be slipped over the end of the motor shaft and clamped in place. The outer end of this sleeve carries a rod at right them in any position on the two arms. Definite positions are marked on the arms, and by means of curves the power developed by the motor with the vanes in any position and at any given speed can be read off directly. The dynamometer is calibrated by means of a cradle dynamometer, upon which the test motor is placed. The apparatus is simple and gives a steady load, besides being cleanly and easy to control.—Electrical Review (N. Y.)

LEAKAGE IN COMPRESSED AIR PLANTS.

Few people, says "Power," realize that leakages plays an important part in the efficient operation of a compressed air plant. Many concerns will go to great expense in installing high-class air compressors with compound steam cylinders and two-stage air cylinders, but when it comes to installing the pipe line the utmost carelessness is displayed, the same fittings being used that would apply to a steam line, without the fact being taken into consideration that steam and air are two very different substances. The heat of the steam tends to keep joints tight which, if cold, would leak considerably. One has only to go into an ammonia refrigerating plant to be convinced of this fact. In such a plant special ammonia fittings are generally used to guard against leakage in cold pipe joints. These fittings comprise a pair of flanges with a rubber sleeve held between them, which is compressed when the flanges are drawn together. One would naturally believe that such a connection would be absolutely tight; but this is not always the case, as there are very few ammonia plants in which the odor of ammonia is absent. How much more must this leakage be in a compressed air plant where ordinary pipe fittings are in use and where the escape of air is not noticeable to the senses and so is less likely to be detected.

If a vacuum were pumped upon such a system and the pump were stopped, it would require but a little time for enough air to leak in to spoil the vacuum. How much greater then must be the leakage outward with a hundred pounds pressure to induce it.

THE ECONOMICS OF ELECTRIC COOKING.*

By Charlotte Dezell Seaver, B. S.

The question of the utility, economy and practicability of electric heating and cooking is one which is now engaging more than usual attention. The query naturally arises as to whether the general use of electricity for cooking purposes, to the entire exclusion of fuels, might be seriously advanced; and, at the same time, whether it would satisfy all demands, as well as come within the means of people of moderate circumstances. Magazine articles appear, from time to time, advocating its use on the grounds of simplicity, availability and cheapness. Nothing appears in the way of satisfactory statistics, however, to corroborate the statements made. The uninitiated would adopt its use at once, were it not for the first cost of apparatus. In almost all cases this is too high for people of ordinary means.

Authentic records exist on the cost of electrical cooking from investigations made by Prof. John P. Jackson, of Pennsylvania State College. His experiments were made with entire meals, for a family of six, and covered a period of several weeks. The paper referred to contains a tabulated report for a breakfast, dinner and supper, which was thought to be a fair average of the whole period. It considered: 1, the time consumed; 2, utensils used; 3, food cooked; 4, amount of current used; 5, cost. The foods were not weighed nor measured; no account was taken of the time required for getting up the temperature to that required for effective cooking; while comparisons of relative costs were made only with coal. No experiments were made with gas, gasoline or kerosene, which are the favorite fuels for cooking in a small way. The average cost per meal, including the heating of water to wash dishes, was 16.6 cents. The same foods, cooked on a No. 8 "Othello" coal range, required an expenditure of 3.15 cents per meal. These results show that at that time cooking by coal was about 19 per cent. of the cost of cooking by electricity.

The aim of the present article is to give statistics and results of a series of experiments in electrical heating and cooking, as conducted in the Home Economics laboratory of the Thomas S. Clarkson Memorial School of Technology, during 1904-1905. Articles of food were cooked by electricity, which would give a fair estimate of its efficiency, practicability and economy for this service. The first experiments were made by cooking certain specific articles of food. These were followed by a series of whole meals, consisting of a breakfast, luncheon and dinner; e. g., Experiments X, XI, XII.

The conditions governing the experiments were as follows:

1. All articles were weighed or measured.

2. The amount of time required was reckoned from the instant that the current was turned on the apparatus till the operation of heating or cooking was completed.

3. With the exception of the whole meals, the same articles of food were cooked in coal, gas, gasoline and kerosene ranges, to obtain the relative costs, the fuel in each case being weighed or measured.

4. Electrical heating and cooking apparatus were obtained from different companies for these experiments.

The first group of these, designated as apparatus (A), consisted of (a) Stove, 6-inch, 3 heats; (b) Oven, 20x18 inches, 3 heats; (c) Broiler 9x12 inches; (d) Tea-kettle, 1 quart; (e) Stewpan, 2 quarts.

(a) The stove consists of a round disk of cast iron, on the underside of which are embedded the electric heating wire in a non-conducting and incombustible compound or cement, of patented composition.

(b) The oven is a simple box-shaped arrangement, of sheet metal, thoroughly heat-insulated, so that it is possible to hold the hand against the outside, even when the oven has its highest heat on the inside without a feeling of discomfort.

(c) The broiler is made of cast iron with longitudinal flutings, and set slightly inclined to the horizontal, with a drip groove at the lower edge, to allow the juice of the meat to run off.

(d, e) The tea-kettle and stewpan are made of thin sheet copper and nickel-plated. They are arranged to lock on to the stove.

In all of the apparatus described the heating coils are so placed as to concentrate the heat at useful points, while the supports, or bases, are non-conductors of heat.

The efficiency of the stove of set (A) was found by raising 2 pounds of water from 42 degrees to 212 degrees F.; see experiment I.

The cooking efficiency of the oven could not be determined exactly as there was no way of attaching a thermometer. As it was possible to hold a hand on the outside when bread was baked to a turn, the commercial efficiency was reasonably high, without undue losses; see experiments II, IV, V. In baking, the current was turned on from twenty to thirty minutes before the articles to be baked were placed in the oven, so as to allow for thorough heating. The current was turned off ten minutes before the baking was done, as the oven would remain hot enough to complete the operation.

The broiler was used in much the same way, with the exception that the current was only turned on from five to ten minutes before being ready to cook, and turned off five minutes before the article was entirely done; see experiment III.

All costs have been estimated on a basis of four cents per kilowatt hour. This may be taken as a fair average net price of electricity in an institution or an isolated plant, where such service may be required. In many cities the charge on commercial circuits, for electric heating and cooking, ranges from eight to twelve cents per kilowatt-hour, though circumstances may prevail, as to time of day and duration of demand, effecting slight changes in such schedules.

The second set of utensils, Apparatus (B) consisted of: (a) Stove, 6.5 inches; (b) Oven, 18x10x16 inches, 3 heats; (c) Broiler, 11x17 inches, 3 heats; (d) Water heater, 1 quart.

(a) The stove is similar to the stove of apparatus (A).

(b) The heating wires are imbedded in top, bottom and

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sides of the oven, of apparatus (B) in contradistinction to the oven of apparatus (A), in which latter the heat is applied only in the top and bottom. Aside from this, however, the two ovens are otherwise similar in construction; see experiments VIII, IX.

(c) The broiler of apparatus (B) has three heats, otherwise it is similar in construction to that of apparatus (A); see experiment VI.

(d) The water heater is made of copper, nickel-plated, and has electrical conductors imbedded in the bottom, thus making it as efficient as possible; see experiment VII.

Remarks on Table IV. In all of the above experiments, there were two loaves of bread baked, weighing 1.5 pounds each, and in pans of size 8x6x2.5 inches. The baking was done in regular range baking ovens, for operations with the fuel specified, except in the case of kerosene, in which a blue-flame kerosene range was employed.

Table V. Comparative Cost of Cooking with Various Fuels.

Source of heat for cooking	electricity	coal*	gas	gasoline	kerosene
Amount of energy or fuel required for given cooking operation	1.032 kw-hr	10 5 lb.	20 cu. ft.	0 0832 gal.	0.078 gal.
Cost (assumed)	$0.04 per kw-hr.	$7.00 per ton	$1.00 per 1000 cu. ft.	$0.15 per gal.	$0.14 per gal.
Cost of cooking by given source	$0.0413	$0.0367	$0.02	$0.0124	$0.0109

*On the Pacific Coast the cost of electricity and coal is about twice as great as here given.—Ed.

Results of Electric Heating and Cooking.

Table II. Apparatus Set B.

Table III. Apparatus Sets A, B. Meals Served.

No. of experiment	VI	VII	VIII	IX	X	XI	XII
Apparatus used	broiler	water heater	oven	oven	oven stove broiler	oven stove broiler water heater	oven stove broiler water heater
Operation	broiling	heating water	baking	baking	getting breakfast for six	getting luncheon for six	getting dinner for six
Article, kind	beef steak		4 mince pies	beef roast	cereal, muffins, broiled steak, coffee	cream of celery soup, croutons, lamb chops, potato puffs, baking powder biscuits, salad dressing, cheese straws, peach cobbler, cocoa	tomato soup, toasted crackers, roast chicken with dressing, giblet gravy, mashed potatoes, scalloped cabbage with cheese, porterhouse rolls, grape ice, almond macaroons coffee
Weight (total)	1.5 lb.	2 lb. from 42 to 212 degrees Fahr.		6 lb.			
Size, each			7 in. diam				
Time required, min. 1, from cold to effective cooking temp.	10		30	20			
2, for operation specified	10		35	1 hr. 35 m			
3, total	20		1 hr. 25 m	1 hr. 55 m	1 hr. 45 m	1 hr. 50 m	2 hrs. 30 m.
Energy required, kw.-hr. 1, from cold to effective cooking temp.	0.122		0.9	0.35			
2, for operation specified	0.151	0.1271	0.7	0.96			
3, total kw.-hrs	0.273		1.60	1.31	2.7	3.6	6.23
Cost of operation based on charge of four cents per kw.-hr.	$0.01092	$0.005	$0.064	$0.0524	$0 108	$0.144	$0.25
Remarks	efficiency found to be 87 p. c.						

Table IV. Results of Cooking with Coal, Gas, Gasoline and Kerosene.

No. of Experiment	XIII	XIV	XV	XVI
Fuel used	coal	gas	gasoline	kerosene
Time required, minutes 1, from cold to effective heating temp.	53	10	20	22
2, for baking specified	32	45	30	43
3, total time required for operation	85	55	50	65
Fuel required 1, from cold to effective cooking temperature		3 cu. ft.	0.0416 gal.	0 0312 gal.
2, for baking specified		17 cu. ft.	0.0416 gal.	0.0468 gal.
3, total fuel	10.5 lb	20 cu. ft.	0.0832 gal.	0.078 gal.
Cost of fuel per unit	$7.00 per ton	$1.00 per 1000 cu. ft.	$ .15 per gal.	$ .14 per gal.
Cost of baking operation	0.0367	$ .02	$ .012	$.0109

Table I. Results of Electric Heating and Cooking. Apparatus Set A

No. of Experiment	I	II	III	IV	V
Apparatus used	Stove and teakettle	oven	broiler	oven	oven
Operation	heating water	baking bread	broiling	baking cake	baking
Article, kind		2 loaves	beef steak	angel food	4 apple pies
Weight (total)	2 lb. from	3 lb.	1.5 lb.		
Size, each	42°to 212°F	8 x 6 x 2.5 in.		10 in. tin	7 in. diam
Time required, min. 1, from cold to effective cooking temperature		25	5	15	25
2, for operation specified		32	6.5	45	35
3, total minutes		57	11.5	60	60
Energy required, kw.-hr. 1, from cold to effective cooking temperature	0.1675	0.3785	0.115	0.3468	0.564
2, for operation specified		0.4525	0.158	0.467	0.773
3; total kw.-hours		1.032	0.273	0.8136	1.337
Cost of operation, based on charge of four cents per kw.-hour	$0.067	$0.0413	$0.0109	$0.0325	$0.0533
Remarks	efficiency found to be 57.8 p. c.				

Coal Range Experiment XIII. Four loaves of bread might have been baked and the upper grate of oven used for other purposes. Beef-steak could have been broiled and ironing done without any additional consumption of fuel.

Gas Range Experiment XIV. Four loaves of bread might have been baked, and potatoes for a family of six might have been baked at the same time, otherwise the oven was at its full capacity.

Gasoline and Kerosene Range Experiments XV, XVI. Potatoes might have been baked at the same time with bread, otherwise the oven was at its full capacity.

Comparative Cost of Cooking with Various Fuels. The results set forth in the following Table V, show the relative average expenses of cooking by electricity compared with the different fuels in us, for the same kind and character of cooking operating, the time in each case being based on one hour.

Summary of Conclusions from Experiments. From the foregoing results the advantages and disadvantages of cooking by electricity may be summarized as follows, at the rate of four cents per kilowatt-hour it would cost double that of gas fuel; and, at the prices ordinarily paid for electricity it would cost at least six times that of gas or coal, which are the fuels most commonly used. This fact, together with the initial cost of the apparatus required, would appear to forestall its general adoption at present. While the first cost of cooking utensils seems high, yet an outfit may be obtained for fifty dollars, consisting of an oven, a broiler, a griddle, a six-inch stove, and a flatiron; or, the following combination: a griddle, two six-inch stoves, an oven and a flatiron. Either of these outfits would serve for the necessary cooking for an

ordinary family of from three to six people. A very complete outfit, comprising a slate top table with several outlets, for electrical connections, with cords and conductors and the following utensils: an oven, a broiler, two stoves, a coffee percolator, a quart pot, and a large kettle, may be purchased for $110.00. This is not so much in advance, therefore, of the ordinary complete kitchen outfit as it might appear. Moreover, these cooking vessels are of nickeled copper which is of longer life and is more easily kept in good order than are ordinary utensils. Those utensils that lock on to the stove give the quickest service on account of the close contact. For highest efficiency those water heaters are the best in which the heating coils are imbedded in the bottom. The efficiency of a heater of one quart capacity is about 87 per cent.

The advantages of electric cooking from the standpoint of sanitation and saving of labor consist in the fact that there is no smoke, flame nor soot, and, of course, no ashes nor dust arising therefrom. When in use there is nothing to indicate the presence of heat, for the apparatus has the same appearance as when cold. While the cooking goes on there is little or no appreciable rise of temperature of the air surrounding the utensils. There is no vitiation of the atmosphere and practically no radiation of heat into the room, which would be of great advantage in the summer. The apparatus may be readily accommodated on a table, thus doing away with the bulky range and its fuel. There is no labor in maintaining uniform heat; no danger of fire or explosion, no danger of personal injury or electric shock, as the voltage of 110, which is usually employed, would not produce more than a slight burn on the fingers. Electricity is quite readily obtained for heating and cooking and may be used as has been shown at a reasonably high efficiency. The articles are of superior quality. The work of the oven, for example, is as nearly perfect as possible. The time required, from the turning on of the current to complete the baking of a given article, for instance, may be determined to a certainty. Results which have been found the best by experience may be reproduced easily with the electric oven. It will not burn the top nor the bottom of the food but heats quickly and uniformly. No particular attention is required to be given to what the oven contains, for there is no need of changing a pan containing bread or cake to get a more favorable position. Every loaf of bread or cake may be obtained uniform in height, while all are of that delicious brown so highly desired.

The time required for cooking various articles of food is practically the same as by other methods of heating. It takes the same length of time to boil a potato of given size in one way as in another, to soften the fiber of meat, or to convert dough into perfectly baked bread. The gain in time in electric cooking comes from the heat being so quickly available. For light housekeeping such as is the custom in small city apartments, and in larger houses during the summer months, no other method presents so many desirable features. Gas, gasoline and kerosene are, of course, extensively used, but with the disadvantages of greater heat in the room, unpleasant odors, vitiation of air, comparative uncleanliness, and always with some danger.

Notwithstanding all its advantages, both sanitary and labor-saving, the expensive utensils and the high price charged per kilowatt-hour for the service will nevertheless tend to make the general use of electric cooking of slow growth. We firmly believe, however, that it will win its way into public favor. Electricity in the near future will no doubt be so generated as to be brought within the means of almost all of the smaller home circles. The greater comfort and convenience, on the other hand, appeal strongly to the woman doing her own work, either from choice or necessity. Indeed, it is not too much to expect that electric heating and cooking may offer at least a partial and perhaps a complete solution of the domestic service problem, and thus meet one of the highest functions of modern science in preserving the home from the disintegrating influence so imminent whenever some help cannot be obtained for the most ordinary operations of housekeeping and home making.

FIRES CAUSED BY ELECTRICITY AND GAS.

In a recent address before the Berlin District Gas Association, Herr Schaefer of Dessau said that statistics furnished by German insurance companies hardly supported the belief that fire risks were reduced by substituting electric for gas lighting.

In 1883 the electricians were in high hopes that the "alleged immunity from fire risk" of electric lighting would enable them to get reduced rates from the insurance companies. Such reduction of rates was often spoken of, but never came to pass. In 1896 the Hanover Fire Insurance Company told their shareholders that the question of the comparative safety of electric lighting was by no means settled, but that clearly there could be no reduction of rates. In 1898 the German Association of Fire Insurance Companies memorialized the Imperial Chancellor, requesting him to put electrical installations under police control and supervision; and a year after they remarked on the considerable increase in the number of fires due to electricity. In 1901 the Dessau Gas Company inquired whether they could get reduced rates on replacing gas by electricity, and were told that under no circumstances could there be a reduction, but that there might be an increase unless the installation was put up and maintained according to the regulations of the Fire Insurance Association.

In Germany there are two groups of insurance companies —18 private companies and 36 public associations. Both of these groups have published some statistics. Those of the former group appeared in Neumann's "Vereinsblatt fur Deutsches Versicherungswesen"; those of the latter group in the year book of the "Mitteilungen fur die offentlichen Feuerversicherungsanstalten." The author has summarized these statistics in diagrams, which show that the fires caused by gas and electricity fall far below those due to explosion of spirit or petroleum, or to children playing with matches. In 1899 and 1900, children with matches caused 1125 and 963 fires in the purview of the 18 private companies; explosions of mineral oil caused 1583 and 1627; electric failures caused 204 and 226; explosions of spirit (alcohol) 207 and 207; and gas explosions 158 and 199. Under gas explosions are reckoned acetylene, producer gas, oil gas and the like, as well as coal gas.

Unfortunately, these tsatistics of the 18 private companies were not continued in this form beyond the year 1900. The fires due to electrical causes in the years 1901-4 amounted, however, to 265, 238, 248 and 278—absolutely almost constant; but relatively to the increase in electric lighting, these figures show a diminution. In 1903 there were 98, in 1904 there were 208 fires due to explosions of alcohol—an enormous number, having regard to the small extent to which spirit has come into use. Petroleum lamps, matches, and the children who play with them, seem more in need of police supervision than electric installations do.

As to the 36 public insurance associations (which insure

Unfortunately, these statistics of the 18 private companies do more business in) the results are much the same. Their data show the following:

	1897.	1898.	1899.	1900.	1901.
Total number of fires...	16,950	17,133	18,947	18,316	19,941
Whereof caused by—					
Children and matches.	967	1,012	1,128	1,080	959
Petroleum explosions.	367	362	414	354	415
Gas explosions	67	68	65	57	87
Electricity	22	25	51	42	73

During the five years, 5.64 per cent of all the fires were occasioned by children playing with matches, 2.09 by petroleum explosions, 0.38 per cent by gas explosions, and 0.23 by electricity. The number of fires due to electricity increased much more rapidly, in comparison with those due to gas, than the relative expansions of electric and gas lighting would indicate. Here also "gas" includes acetylene, etc., as well as coal gas. It is worthy of note that both gas and electricity were responsible for a relatively small number of fires.

The statistics of the Berlin fire department show that the number of fires have by no means kept pace with the expansion of the two systems; that out of every 900 electric services there is one fire per annum, while with gas there is only one fire per 8000 services. In Berlin last year (1904-5) there were 12,788 fires, of which 30 were due to gas, 25 to electricity, 77 to children, 18 to petroleum.

During the five years, 1900-1 to 1904-5, there were nine fires in electric works in Berlin; one in a gas works; 29 fires in electric works all over Germany. During the same period there were 66 fires in Berlin theaters, of which 21 were due to electricity; once to four times in almost every Berlin theater; and it was only the continuous supervision which prevented these becoming dangerous. During the same period 32 shops were set on fire by electricity.

A LOW VOLTAGE SHOP TROLLEY CIRCUIT AND SOME OF ITS ADVANTAGES.*

Often the power house of a large railway system is located in close proximity to the repair shops, and considerable trouble is experienced thereby through the opening of the circuit-breakers in the power house and often the throwing of rotary converters out of phase by reason of heavy loads on the shop feeders, caused by defective motors on cars or by accidental short circuits occurring in the shops. The ordinary voltage employed on the shop trolley wires, moreover, often causes the burning out of rheostats under the cars when attempting to move cars slowly. In addition, the high voltage does not permit of slow and steady pulling of cars in switching, and in fact introduces so many difficulties as to cause the question to arise as to the advisability of supplying the shop trolley circuits with a voltage considerably lower, say even about half, that ordinarily used on the line.

The advantage of a reduced voltage will be understood by every shop man who has to do with moving cars and switching. With the voltage ordinarily used, in order to make a car move slowly, the motorman must continually work the controller alternately, turning the power on and off. When a heavy load is being pulled, this jerking of the train is objectionable and usually the only means of avoiding it is to run on the first resistance point, if this point will give the low speed desired. But if care is not exercised, and frequently it is not, the rheostats are likely to suffer under this latter method of handling the car. With about 300 volts on the shop trolley the car, when starting under a heavy load, would accelerate more smoothly, and throwing the controller to the series position would not usually give too great a speed. But if it should be found necessary to run on the resistance points, there would be very little likelihood of the rheostats getting too hot under ordinary treatment, as the current would be cut down to half what it is at present.

In addition to the benefits gained in switching and in moving cars, there would be other decided advantages with a lower voltage on the shop trolley. There is very little danger of a pressure of 250 or 300 volts seriously injuring any one who gets across the circuit with his hands or with any portions of his body. In fact, unless the contact is a very good one, such as might be caused by wet hands, the shock from a 300-volt circuit is so mild that it does not inspire that feeling of fear which most have when working with a 600-volt circuit. With this lower voltage, therefore, there would be no occasion for many of the usual safeguards for protection when working with "live" apparatus. Much time would be saved by the omission of these precautions; and further, the freedom from fear with which the car apparatus would be handled would permit a great deal of the work to be done more rapidly.

With regard to the fire hazard, marked benefits would accrue from a reduced voltage on the shop trolleys. Many car-house fires, it is safe to presume, have their origin in electric heaters which are left on over night in cars stored in the shops. The reduced voltage would be an effectual means of preventing fires from overheated electric heaters, as with half the current it would be almost impossible for the heaters to get hot enough to ignite the car.

About the only objection from the shop standpoint which occurs to us to the plan of lowering the voltage on the shop trolley is the effect it would have on the lights in the cars. The car lights are frequently employed to light the interior when repair work is being done on the car while in the shops or while the car is being cleaned. With the lower voltage, these lights would be practically of no benefit, as with about 50 per cent. of the normal voltage on an incandescent lamp, the filament has only a red glow and does not give off much light. Electrically driven air pumps would work slower with the low voltage, and some other minor disadvantages might appear.

We admit, on the other hand, that if it were decided to supply the shop trolleys with a lower voltage, there would usually be considerable difficulty in bringing it about. It would be necessary either to place a resistance of a few ohms in the feeder from the power house or to put the shop feeder on a separate machine. Reduced voltage might also be obtained from a storage battery. The plan of using a separate machine would be preferable, but the cost of this extra machine would be rather a drawback in the first place, and in addition, as the load factor on a shop circuit is under ordinary circumstances very low, the machine supplying the circuit would run at a rather low efficiency for the greater portion of the time.

It would be very easy and very inexpensive to put a resistance in the feeder supplying the shop circuit, but this plan would not give all the benefits of a low voltage, as the voltage would fluctuate with the load. So far as pulling heavy loads and switching is concerned, the desired results would be obtained, but with no load on the circuit the voltage would be that of the generating machine, and the injury to a workman getting across the circuit would be the same as at the present time. And in addition the fire hazard would be about the same as at night. With only a load of a few heaters, these heaters would become about as hot as if there were no resistance in the feeder. A decided disadvantage would develop in that the men could not get accustomed to one voltage, and would consequently never know just how quickly a car was going to move when they turned the controller handle.

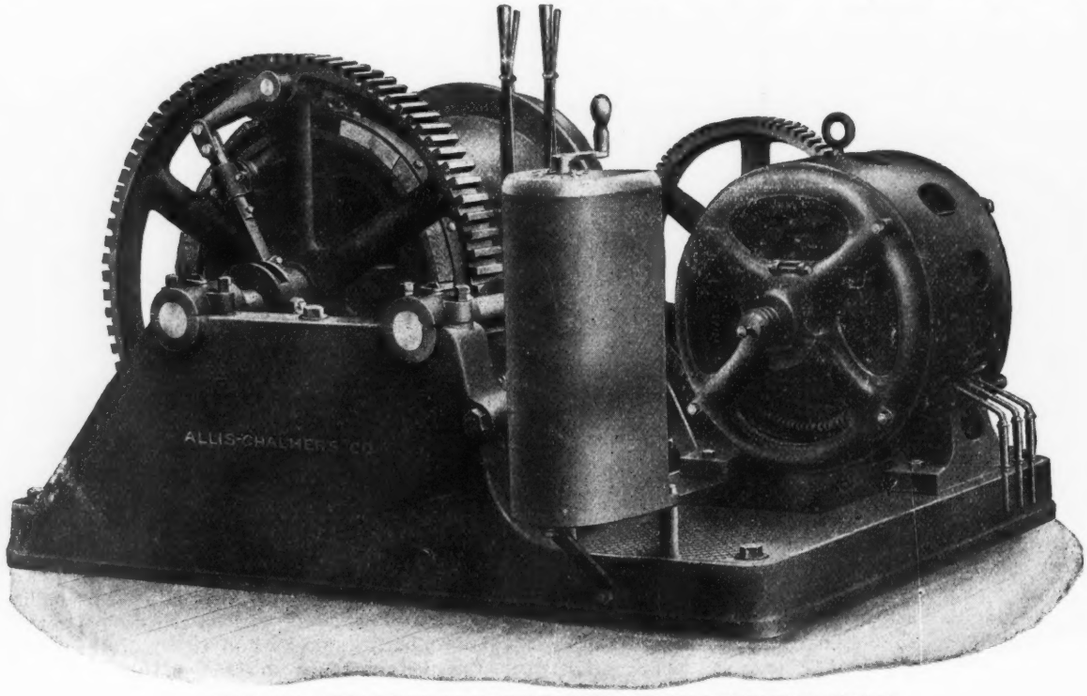
Wherever a storage battery is floated on the line and is available for connection, the desired voltage might be obtained by tapping in the shop feeder circuit, so that but half the total voltage of the line would be obtained. In such a case it would be necessary to connect the battery in two halves, and arrange switches and connections so that the two halves could be transposed to either the ground or the trolley side of the circuit. That half supplying current to the shop feeder would necessarily be connected on the ground side, and the fact that the shop circuit would have to be fed alternately from each half of the battery, in order to prevent over charging and over discharging of the battery, would necessitate the arrangements for transposition of the halves.

*Street Railway Journal.

INDUSTRIAL

ELECTRIC HOISTS.

Electric hoists, in order to give the best service, must be designed and built especially to meet operating conditions. When so constructed, and properly installed, they are as easily handled and give as good results as steam-driven machines, while they are as readily controlled, are as little liable to get out of order and require no more skillful operators. They should be heavily and substantially built, and the motor particularly adapted to its work. In many cases the electric hoist possesses very considerable advantages over air or steam-driven hoists, as in underground locations at some distance from the power source. It is much easier to run wires than pipes, and losses from condensation and leakage are avoided.



SINGLE DRUM ELECTRIC HOIST DRIVEN BY AN INDUCTION MOTOR.

The Allis-Chalmers Company, of Milwaukee, has recently put upon the market a line of standard machines designed to work under approximately the same conditions as its well-known small steam-driven hoists. The single-drum electric hoists are built for full load capacity of 15, 25, 35, 50 and 75 horsepower and the double drum hoists for capacities of 30, 50, 75, 100, 125 and 150 horsepower, respectively. The rope speeds selected for these capacities are such as to meet average requirements and insure reliable and economical operation.

The drum and motor are mounted upon a heavy, substantial cast-iron bed plate of box section, with broad bearing surface on the foundation. The bearings are carried on pedestals cast in one piece with the bed plate thus maintaining the alignment of the shafts. The drum runs loose on the shaft and is made in one piece, also of cast iron. The spider hubs are fitted with bronze bushings, which can be replaced in case of wear. The drum spiders have ribbed arms, and the drum shell is reinforced by deep circular ribs to take up all twisting and bending strains. The face of the drum is straight.

The brake is of the steel-band type, with a wide face, and is provided with suitable turnbuckle adjustment for taking up the wear on the brake blocks. One end of the brake band is securely anchored by eye bars around the operating shaft and the other end has a turnbuckle attachment to the lever on the operating shaft controlled by the operator's hand lever.

The main gear, keyed on the drum shaft, forms the driving member of the clutch, which is of the band friction type. The fixed end of the band is securely anchored to the driving gear and has suitable adjustment for shortening the band to compensate for wear. The movable end of the band is actuated by a simple and strong arrangement of a toggle lever, motion to which is imparted by a collar sliding on the drum shaft and controlled by the operator's hand lever through suitable connections. When the clutch is thrown in, the band is tightened around the drum shell by the powerful toggle motion, and the pull of the rope on the drum tends to still further tighten the grip of the band on the shell, thus securely holding and lifting the load. Both band friction clutch and band brake are hand operated, the operating levers being conveniently arranged, and provided with quadrants and locking pawls.

The gear blanks are cast from a special quality of tough, strong iron and have heavy rims, arms and hubs. The pinions are of cast steel. The teeth of both gear-wheels and pinions are cut.

For driving these hoists, the Allis-Chalmers Company furnishes either direct or alternating current motors wound for the common voltages. Alternating current motors may be had for frequencies of either 25 or 60 cycles.

The controllers used with these hoists are of the drum type, similar to those in common use in street car service. On all single-drum hoists the motor is not reversed, but on double-drum hoists the handle or lever of the controller not only controls the speed but also reverses the motor, and is locked in the off position. The controller is securely attached to the frame of the hoist, and the lever is so located as to be conveniently reached and easily handled by the operator. The lever of the controller is also made of the same design as the brake and clutch levers when so desired.

On account of its wide experience in the design and construction of mining and electrical machinery, the Allis-Chalmers Company has met with considerable success in their installation of electrically-driven hoists.

NATIONAL STEEL TUBE CLEANER.

The salient feature of the National Steel Tube Cleaner, as illustrated above, is that each blade acts independently of the others and is so spring-like in nature that it conforms very snugly to the surface which is to be cleaned. It can be forced through the tube with very little effort, and each plate

removes the particles of sediment or scale within the pipe. Another advantage of this Cleaner is that it can be adjusted to fit various sizes of pipe, and if one or more of its blades become broken by rough usage or wear, they can be readily repaired at a nominal expense.

The National Steel Tube Cleaner is manufactured by the H. W. Johns-Manville Co., with branches in all large cities, and we understand that they are meeting with great success in the sale of this device.

$2,600 IN PRIZES FOR AN ELECTRICAL SOLICITOR'S HANDBOOK.

The stimulating character of the papers on The Organization and Conduct of a New Business Department for Central Stations, which were presented in the hope of capturing one of the prizes offered by the Co-operative Electrical Development Association, has led this Association to offer $2,600 in prizes for the best material for an electrical solicitor's handbook.

The book is to be divided into three sections, which will be considered separately. The first will deal with the sale of electricity for lighting; the first prize is $500; the second, $300; and the third, $200. The second section will deal with the sale of electricity for power purposes; the prizes being the same as for the first section. The last section will be devoted to the sale of electricity for heating. The winner of the first prize will receive $300; of the second, $200; and of the third, $700. A pamphlet is being prepared containing suggestions for those who intend to compete, and will be mailed on request at the offices of the Association, 1814 Forty-fifth St., Cleveland, Ohio. The commercial importance of the subject, together with the prizes offered, should result in the publication of a very commendable book.

SOME RECENT WESTERN SALES OF THE ALLIS-CHALMERS CO.

The Edison Electric Company, of Los Angeles, has ordered for its hydro-electric plant on the Kern River, at Edison, Cal., eight direct-current motors with controllers and gearing equipment, to be used for operating 28-inch gate valves. The motors will be 120 volt, series-wound machines of the vertical shaft type, fully enclosed, and especially adapted to the service required. This company has installed on the Kern River at Caliente five 3200-kilowatt Allis-Chalmers alternating current generators direct connected to Allis-Chalmers hydraulic turbines, forming one of the largest long-distance transmission plants on the Coast.

The Douglas Improvement Company, of Douglas, Ariz., has contracted with Allis-Chalmers Company, from whom it recently purchased a 325-kilowatt electric generating unit, for the delivery of 30 small static transformers, and 9 induction motors to operate on two-phase current at 60 cycles and 2,200 volts. These motors are to range in size from 2 to 10 horsepower, and will be used for various purposes.

SIXTY-FIVE MILE INTERURBAN LINE IN TEXAS.

Contracts have been let by the Texas Traction Company for the equipment of a sixty-five mile electric road between Dallas and Sherman, Texas. The new line will parallel the existing steam road between the two cities and will be one of the longest electric roads in the State. While the apparatus is standard direct-current throughout, the equipment, in some respects, presents several features of interest.

The country, through which the new line is laid out, is flat and rolling, there being no grades exceeding 10 per cent., and the maximum curvature is but three degrees. In order to have a clear headway for operating cars, a private right-of-way has been established by the company, so that the run between Dallas and Sherman will be made in two hours and thirty minutes. The schedule includes a fifteen-minute run within the city limits of Dallas, where the cars must necessarily be operated at lower speeds. While the main traffic will be of an express nature, stations have been provided about every two miles to take care of the local travel.

Fifteen car equipments will be provided to maintain the initial schedule. These will be of the standard interurban type, each fifty feet long, and equipped with four GE-73 (75-horsepower) standard direct-current motors under the Sprague-General Electric Type "M" system of multiple unit control. Each car will be further provided with General Electric air brakes and compressors.

Power for the new road will be generated at a steam plant at McKinney, located about midway between Dallas and Sherman. The main power station equipment will include two 1,000-kilowatt Curtis steam turbo-generators working under a steam pressure of 150 pounds per square inch at the throttle, with 125 degrees superheat. The turbines will be of the condensing type. Alternating current will be generated at 2,200 volts and 25 cycles and stepped up for transmission to 19,100 volts. For exciting the fields, two 35-kilowatt generator sets will be provided. The compactness and low maintenance charges of these machines make them especially suitable for exciting units.

The three-phase current from each of the turbo-generators will be transformed in a set of three 330-kilowatt, air-blast transformers. One transformer of the same capacity

will be installed as a reserve. To supply air for cooling, duplicate blower sets will be furnished, one set being driven by an induction motor, the other by a direct current motor. Each blower will have a capacity of 10,000 cubic feet.

One of the special features of interest in the new road lies in the rotary converter equipment. Six sub-stations will be provided, including one at the main station as well as a portable equipment. This last-mentioned sub-station comprises a special car containing a 300-kilowatt rotary converter, air-blast transformers and suitable switching apparatus for cutting into the transmission system wherever necessary. The portable sub-station renders unnecessary the duplication of rotary converters at the fixed sub-stations for the portable equipment can be shifted to various parts of the line and used as an emergency station or auxiliary in case of need.

Regular sub-station equipments are to be provided at the main station and at four points distributed along the railroad. Each of these sub-stations will be equipped with a 300-kilowatt, 600-volt rotary converter with the necessary switchboards, oil-cooled transformers and lightning arresters.

Tse sub-stations will be inter-connected by high-tension transmission lines, operated initially at 19,100 volts. Eventually, however, a transmission potential of 33,000 volts will probably be used, and for this purpose taps will be provided for "Y" connection of the transformers. With the few exceptions noted the new line follows, in general, the standard direct-current practice of the General Electric Company.

NEWS NOTES

ELECTRIC RAILWAYS.

Oakland, Cal.—E. E. Calvin, general manager of the Southern Pacific, says that contracts to the amount of $1,881,600 have been let for work on the tranformation of the company's local ferry lines into electric lines. These contracts effect the Alameda mole lines to Fourteenth and Franklin streets, Oakland, and to High street in Alameda. The Seventh street line will be electrified as far as Melrose.

San Francisco, Cal.—The Board of Supervisors has adopted a resolution declaring its intention to proceed with the construction of an overhead electric trolley railroad with a modern equipment on Geary street from Kearny to Point Lobos avenue, and on Point Lobos avenue to Tenth avenue, and to Golden Gate Park.

Oakland, Cal.—The San Francisco, Oakland, and San Jose Railway Company has applied for a franchise, which practically covers the water front in West Oakland, and also laps over on the franchise asked for by both the Western Pacific and the Santa Fe roads. The Key Route people have an absolute ownership of several hundred acres of water frontage, extending from the Key Route pier, and it is proposed to establish here an immense basin, which will be dredged, in order to permit of the construction of berths for at least 100 seagoing vessels. This will involve the expenditure of several millions. The franchise asked for is for 50 years, and except for the stipulation that electricity shall be used for motive power, is similar to those of the two other roads named, the applicants promising to grant the same privileges to other roads as is guaranteed by the other petitioners.

Suisun, Cal.—Considerable interest is now manifested in a project for an electric railroad line in Solano County. The route proposed is from Vallejo north, passing through American Canyon, Suisun Valley, and a mile north of Fairfield, taking an easterly direction to Cement and through Elmira, Dixon and Sacramento. While the main line will not touch Fairfield and Suisun, Mr. Dozier, the civil engineer, states that a spur track can be run into Fairfield and Suisun and a branch line to Vacaville.

San Diego, Cal.—A petition has been granted by the city council to the San Diego Electric Railroad Company for franchises to operate and construct three lines in the city, which will run on Third, Center, D, H, Eight and Atlantic streets, and to the wharf of the Santa Fe Railroad Company. Work on the construction of the South Park and Eastside trolley line, which is to run down C and F streets to Fourth, has already begun.

Marysville, Cal.—It seems now that there will be some delay in installing the Northern Electric Company's street railways in Marysville, and that for awhile only interurban cars will be operated here. The reason for this lies in the fact that the Marysville Water Company, through Attorney Richard Belcher, has gotten out an injunction against the railroad people restraining them from laying the second track along Fifth street. The water company claims this second track will be over its water mains, and will interfere with the repairing of the pipes or with making connections. They claim they had a franchise for the use of the streets first, and that the railroad company should move the pipes at its own expense.

Martinez, Cal.—W. S. Ream, manager of th eStandard Oil Company, was here last week making arrangements for the preliminary work on the new electric street railway line which will cover the principal thoroughfare of this place. Mr. Ream announced that the material for the new line had already been purchased in the East, and was now on the way, and that within a few months the road would be completed, as it was the intention of the company to rush the work as rapidly as possible. While here he gave out the information that as soon as the Martinez line was completed and in operation the Standard Oil Company, acting under what is known as the Beasely franchise, proposes at once to construct a network of electric lines through Contra Costa County. The main

Seattle.—The Seattle Electric Co. announced that within 90 days the rails for the car line from Youngstown to Alki Point, via the shore route, will be laid.

Seattle.—The Board of Public Works granted a permit to S. E. Co. to erect iron poles along Westlake boulevard.

Wallace, Ida.—The council granted a franchise to William J. Hall to build and operate an electric railway through the streets of the city.

TELEPHONES AND TELEGRAPH.

Bellingham.—Ed. Brown of Custer, was elected president of the Farmers' Mutual Tel. Co. of Whatcom county. The directors are Luke Norton, Blaine; Ed. Brown, Custer; W. L. Galbraith, Lynden; P. D. Harkness, Everson; James Bailey, Nooksack; J. N. Miller, Ferndale, and L. G. Van Valkenburg, Sumas.

North Yakima.—J. C. Dresel, superintending architect of the Pacific States Tel. & Tel. Co., states that when improvements under way here are completed they will cost $250,000.

Puyallup, Wash.—The Sunset Telephone Co. is preparing to rebuild its entire exchange.

Spokane.—According to plans filed by the Home Tel. Co. the new system will have two underground conduit systems to supply the business section of the city.

Tacoma.—Work is progressing rapidly upon the installation of the new switchboard of the Sunset Tel. Co. and will be completed about April 1st.

Spokane, Wash.—The Farmers' Telephone Company, of Pullman, Wash., has decided not to operate in conjunction with the Pacific States Telephone & Telegraph Company.

against the power companies.

points to be covered will be Pacheco, Concord, and Walnut Creek, although every point of vantage in the San Ramon Valley will be reached, and it is extremely probable that connections will be made with an electric line from Martinez along the coast line to Richmond. It is expected that not only will the new corporation reach out for passenger traffic, but will also enter the freight business and open up a new outlet for the produce of this county.

OIL.

Los Angeles, Cal.—A great handicap to the oil industry in Califarnia at this time is the shortage of tank oil cars, which has grown until it is said that there are not more than half enough of these in commission to handle the product. Six hundred additional cars are badly needed at the present time. In their absence it has been necessary to provide expensive storage accommodations, and to keep vast quantities locked in the ground by means of tightly plugged wells. Oil operators and railway officials agree that it is a edplorable condition. The latter claim that it is something that cannot be remedied immediately. The Southern Pacific, Santa Fe, and Salt Lake railroads have each ordered additional equipment.

TRANSMISSION.

Redding, Cal.—The Crown Deep mine, in the Lower Spring district, which has been sold to Philadelplhia capitalists, will be operated by electricity. A pole line from Shasta will be put in to connect with the Northern California Power Company's line. An electric hoist will be installed.

San Bernardino, Cal.—Plans for two big water power plants for Waterman Canyon have been drawn, and those backing the venture seem to be in earnest. Henry L. Green, of Los Angeles, states that it is the intention to install one power plant at the mouth of the canyon on the north bank of the stream. Three miles further up teh canyon the second will be installed.

Benson, Ariz.—Matt Rodgers, manager of the Santa Rita Water and Mining Company, states that his company will put in a modern Risdon bucket gold dredge of the continuous chain type on its placer property about the first of May. These are to be operated by electric power, to be generated by the company's plant. The property of the company is about 12 miles from Sonorita.

Kingman, Ariz.—S. R. Porter has returned from Los Angeles where he went on business in connection with the early convertion of the Gold Road mill from gasoline to electric motive power. Some large motors have been ordered which will displace the several gasoline engines, and electric hoists will also be used on two shafts. The initial station at Kingman is to have capacity of 2,400 horsepower more than 500 of which is to be used by the Gold Roads Company alone.

Bisbee, Ariz.—An electric appliance for running four drills is to be installed on the Oretga mine, which is situated seven miles south of Cananea. Bryan K. Morse is superintendent of the Oretega, and R. B. Wadleigh is general manager.

INCORPORATIONS.

Los Angeles, Cal.—The Coalinga Consolidated High Gravity Oil Company is a new corporation formed at Los Angeles to go into the fuel oil business. The incorpoartors are: J. R. Johnson, E. A. Meserve, O. S. Chandler, J. P. Chandler, and Shirley C. Ward, all of Los Angeles. The capital stock is to be $2,500,000 in $100 shares, but only 14 shares have been subscribed.

Los Angeles, Cal.—The Vermont Avenue Water Company has been incorporated with a capital stock of $6,000, of which $140 has been subscribed. The incorporators are: Joseph Bohon, Emil Firth, B. Edwards, Chas. Dougherty, and H. C. Moore, and C. T. Tamplin.

San Luis Obispo, Cal.—The East and West Oil and Mine Company has filed articles here.

San Francisco, Cal.—The Sunset Monarch Oil Company has been incorporated here with a capital stock of $500,000, subscribed $50.

Williams, Cal.—The Colusa County Telephone Company has been incorporated here with a capital stock of $100,000. Directors: C. L. Schaad, G. C. Comstock, of Williams; J. F. Campbell, of Makwell; W. T. Rathburn and Oscar Robinson, of Colusa.

Los Angeles, Cal.—The Santa Ynez Oil Company has been incorporated with a capital stock of $500,000; subscribed, $1,000, by D. W. Stewart, F. A. Garbutt, W. A. Hendryx, L. M. Martin and W. R. Stewart, Jr.

Los Angeles, Cal.—The Earlmart Water Comapny has been incorporated here with a capital stock of $50,000; subscribed, $125, by H. S. Miller, W. T. Boone, R. W., W. H. and Anna B. Wise.

Los Angeles, Cal.—The Palms Land and Light Company has been incorporated here with a capital stock of $1,000,000; subscribed, $70, by W. R. Wheat, C. N. Gary, M. R. King, J. U. Zallee, F. B. Clarke, Jr., A. J. Korbel, and E. S. Shank.

FINANCIAL.

Los Angeles, Cal.—The daily papers have published a statement to the effect that E. H. Harriman has determined to set aside the sum of $10,000,000 for the improvements of the Los Angeles Pacific Railway system, which extends from this city to Santa Monica, Ocean Park, and Venice, and that he will unite with H. E. Huntington in the venture. It is stated that it is the intention of the Harriman agents to arrange for the construction of a series of subways to parallel Fourth street, and that a ten-story building will be erected as a terminal station. Agents of Harrima ninterests are understood to have purchased already over $1,000,000 worth of property on Hill street, and it is expected that the city council will be asked for a franchise to construct the necessary tunnels.

New York.—The Great Western Power Company, of California, has filed a mortgage to the Central Trust Co. of New York as trustees to secure an issue of $25,000,000 in 5 per cent gold bonds, dated July 1, 1906, and due July 1, 1946, but subject to redemption after five years at 106 and interest. Of this issue, $8,500,000 is outstanding. This company has recently incorporated under the laws of California with an authorized capital of $25,000,000 as the operating company for the Western Power Company of New Jersey. The latter is a holding company with $18,000,000 authorized capital stock. Edwin Hawley is president of the company. The Great Western Power Company expects to furnish power, light and heat to all towns in Northern and Central California.

San Francisco, Cal.—The Commercial Petroleum Company, whose office and principal place of business are in San Francisco, with works in Fresno county, has levied an assessment on one dollar per share upon the capital stock of the corporation, payable immediately to the secretary, Harry B. Gregg, at the office of the company, 142 Steuart street, San Francisco.

San Francisco, Cal.—The Lindsay Water Development Company has levied an assessment of $200 per share on its capital stock, payable at once to the secretary, F. F. Hostetter, Lindsay, Cal., Cal. The sale day is January 5th.

TELEPHONES AND TELEGRAPHS.

Oakland, Cal.—A trust deed has been placed on record whereby the Home Telephone conveys to the Mercantile Trust Company, of San Francisco, all its property in Alameda County as security for a bond issue of $5,000,000, all of which has been taken by the Trust Company. The property consists of land on Franklin street south of 19 th street, and the telephone wires and appliances of the system.

Reno, Nev.—The American Bell Telephone Company will purchase franchises of the private telephone lines in Nevada. Wires will be extended from Reno through Carson to Tonopah, Goldfield, Rhyolite and Manhattan, thence north to Eureka to connect with an extension from Salt Lake, thus giving the Bell Company a through line from Salt Lake to San Francisco. G. R. Bush is visiting the principal towns of Nevada in the interests of the American Bell Company, as the forerunner of a syndicate to control all the private lines in this State. Mr. Bush is head of the construction department of the Pacific States Telephone and Telegraph Company. He was sent from San Francisco to inspect the different private lines here and report on the advisability of ecquiring this territory by the syndicate. In Rhyolite, Goldfield, Tonopah, Manhattan, Austin Ely, and Fairview, the telephone service is furnished by private lines. The wires are carried only short distances across the country; consequently, the service is not as good as it could be made. It is the plan to acquire these private lines and merge them all with those of the Pacific States Company into one corporation under the American Bell Company's contract.

San Francisco, Cal.—The highest price paid for San Francisco real estate since the fire is represented in the purchase by the Pacific States Telephone and Telegraph Company of a lot, 66-21:6 feet, on the northwest line of Market street, adjoining the Crocker building. The lot was sold for $90 a square foot, or $6,000 a front foot. The seller was E. J. Hooper, and the buyer E. J. Zimmer. The company will erect a building on the lot to be used as a pay station. The station will probably transact a large ubsiness when the new Palace Hotel on the opposite side of Market street opens its doors to the public.

Oakland, Cal.—The Committee on Auditing and Finance recommended that the Board of Public Works be authorized to buy an underground cable for the fire alarm and police telegraph department. The recommendation was adopted.

San Francisco, Cal.—The Board of Works has awarded to Harmachan & Ehrhardt a $4,340 contract for constructing a conduit for the city's electric wires on Mission street between Sixth and Ninth streets.

Spokane.—Temporary offices have been established by the Interstate Tel. Co. at 112 S. Post St.

Spokane.—A mortgage of $500,000 was filed by the Interstate Tel. Co. in favor of the Spokane & Eastern Trust Co. to raise money for the building of an extension of the system to Wallace, Ida. The company will then have 450 miles in operation.

The Christian Co-operative Telephone Association, of Sunnyside, Wash., has changed its name to the Yakima Valley Telephone Company. When the association was organized its purpose was to furnish telephone service to its subscribers at cost. Hereafter it will furnish telephone service on such a basis as will earn dividends for its stockholders. The following trustees were elected for the year: W. P. Sawyer, H. M. Gilbert, J. L. Laughlin, of Zillah, and R. D. Young and A. C. Webber.

Spokane, Wash.—Announcement is made that a straight advance of 50 cents a day has been promised to all electrical workers in the employ of the Pacific States Telephone & Telegraph Company, the new schedule to become effective Feb. 2. The advance was granted in response to a demand by the union at the time of its national convention in San Francisco, last October, and will apply to all the men employed in the electrical department.

A farmers' telephone line has just been completed from Colville to Echo, Wash., a distance of 10 miles, and an exchange will be put in at the Echo postoffice. The system will have 30 telephones, and will connect with the Pacific States Telephone & Telegraph Company's exchange at Colville.

Manager Van Dyke announces that bids are being called for for the construction of a two-story building at Wallace, Ida. The building is to be 35 by 30 feet and will be occupied by the Rocky Mountain Telephone Company. The first floor will be devoted to offices, storage batteries, motors and dynamos. The second floor of the biulding will have a cloak room, lavatories and a rest room. The present system will be replaced by the common battery system and No. 9 switchboards will be installed. The system throughout the town is to be reconstructed. The contemplated improvements will cost, it is estimated, in the neighborhood of $30,000.

Spokane, Wash.—Temporary offices have been established at 112 S. Post Street in Spokane by the Interstate Telephone Company. Wires have been installed and the new service is in operation. Most of the towns in the Idaho panhandle are interconnected by this system. In addition to Coeur d'Alene, Rathdrum, Sandpoint, Wallace, Wardner and the mining towns in the Coeur d'Alene district, the towns along the St. Maries and St. Joe rivers, can now be reached over this company's lines. The Rocky Mountain Bell Telephone Company and the Pacific States Company cover a great deal of the same territory, with the exception of that bordering on the rivers, which constitutes the new territory opened by the Interstate. The temporary offices will be occupied for about two months, and permanent offices will be established as soon as a suitable site and building can be secured.

POWER AND LIGHT PLANTS.

Castle Rock, Wash.—H. D. Gates is preparing to rebuild the electric light plant at this place.

Seattle.—The Seattle Lighting Co. has taken out a permit for a two-story steel frame gas retort to cost $25,000 and an $18,000 steel gas generator.

ILLUMINATION.

Sacramento, Cal.—The State Board of Prison Directors has asked Governor Pardee for a new electric plant and a larger appropriation.

San Rafael, Cal.—The San Rafael Gas and Electric Light Company is about to prepare plans and specifications for the extension of its gas mains so as to supply San Anselmo, Ross, Larkspur, Corte Madera, Belvedere, Tiburon, Sausalito, and Mill Valley, with fuel and illuminating gas. It contemplates changing its plant here and removing it to tide water, where it will install a plant sufficient to meet the demands of these localities.

Folsom, Cal.—Sealed bids are being received for furnishing and installing forty 16-candle power incandescent lamps in the town of Folsom for the purpose of lighting the streets and highways.

Pasadena, Cal.—The Board of Directors of the Pasadena Merchants' Association has voted to raise $2,000 and place it to the credit of the Board of Trade for use in lighting the new cluster posts. This action makes it possible for the directors of the Board of Trade to sign a contract for electric energy with the Pacific Electric Company.

Pasadena, Cal.—Sealed bids are being received by the mayor and the city council at the office of the city clerk for furnishing to the city materials to be used in the construction of an electric light distributing system. Bids should include all or a portion of the goods delivered f. o. b. cars at Pasadena, and must be segregated for the several items. Bidders must guarantee date of delivery at Pasadena. Early delivery will be one of the elements consiedred. All bidders must submit with their bids a certified check of 10 per cent drawn on a solvent bank doing business in Pasadena.

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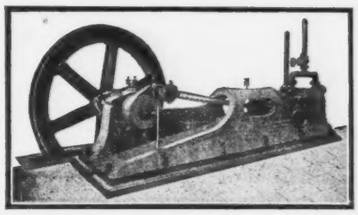

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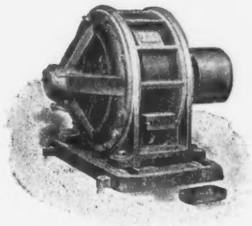

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INDEX TO CONTENTS PAGE VII. CLASSIFIED LIST OF ADVERTISMENTS PAGE XIII. ADVERTISERS INDEX PAGE XVI.

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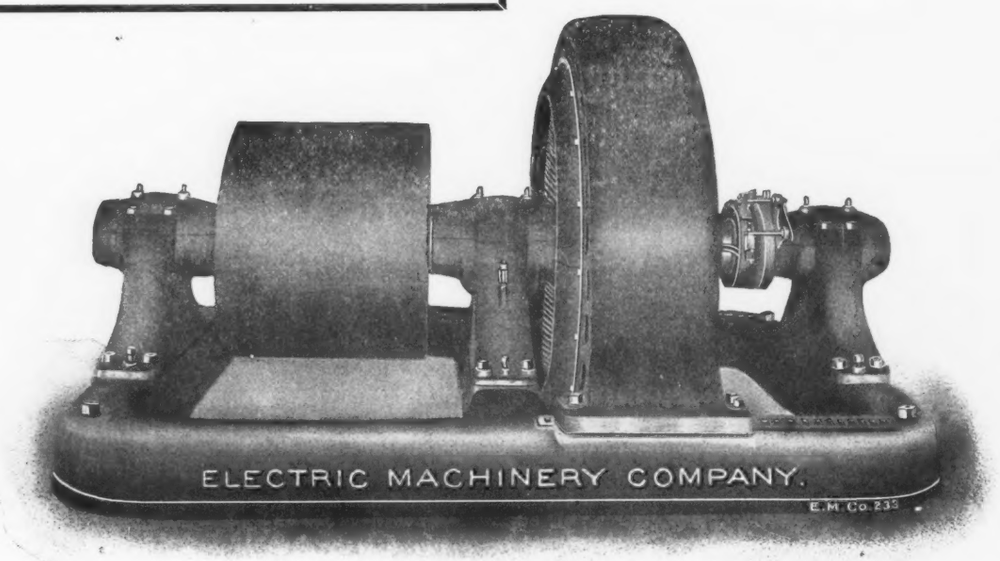

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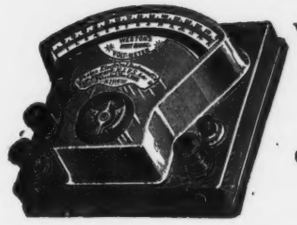

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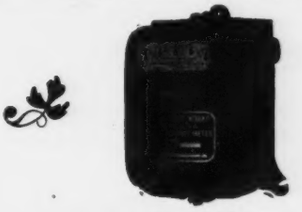

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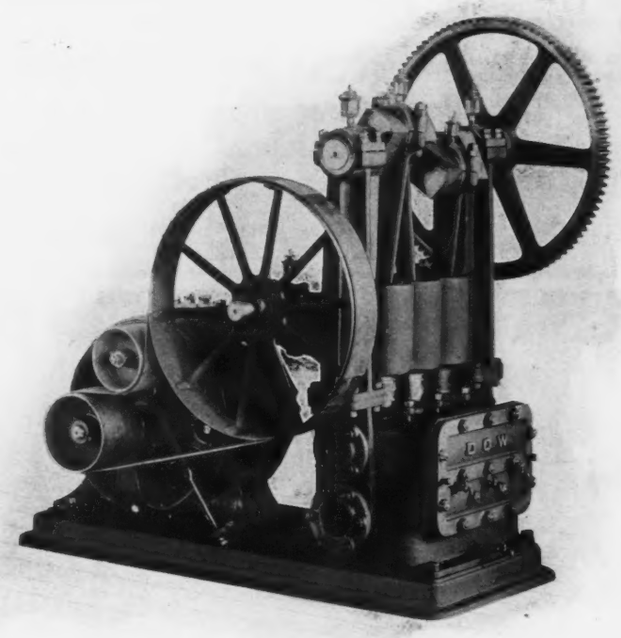

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We feel certain that it will give them pleasure to learn that during the past year our field has been constantly expanding and that our unrivalled prestige in the higher phase of power plant engineering has been more than retained.

To all we wish a prosperous and successful New Year.

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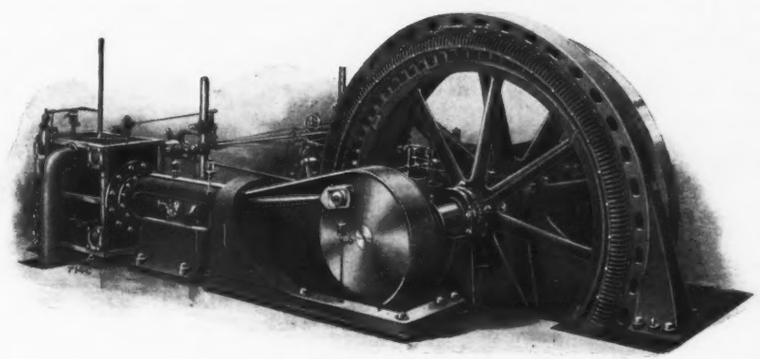

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OUR

SINGLE PHASE A. C. MOTORS

ARE BUILT UNDER

United States Letters Patent { No. 543,836 " 562,365 " 458,162 " 530,176 " 530,177

Also a number of other patents of somewhat less importance

These patents cover broadly, among other things, *the commutator type* of single phase constant speed motor, employing the following fundamental features:

1st. Starting as a commutator motor, and short-circuiting the indvidual armature coils on attaining full speed.

2d. Any single phase motor of the induction type having a coil-wound armature in which rotation is maintained by use of coil connections, which permit the flow of polyphase currents in the armature, while single phase currents are used in the field windings.

We desire to inform the public of the character of these patents, so that the purchasers or users of infringing motors may be fully advised with regard to the matter. We shall prosecute any infringement of these patents. There is no commutator motor *"like the Wagner,"* or *employing the same principles with improvements,"* which does not infringe the above patents.

We *do not* employ the *Tesla* principles in our motor.

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INDEX TO CONTENTS

Illustrated articles are marked with an asterisk (*), editorials with a dagger (†)

The Plant of the Vancouver Power Company (Ltd.) *1
The Jhelum River Power Plant *11
The Evolution and Development of the Steam Locomotive as Evidenced by the Exhibits in the Transportation Building at the St. Louis World's Fair, by William A. Doble *19
The Steam Turbine, by Harry Y. Haden *35
The Fourth Jovian Congress 38
Steam Turbines as Reserve Power in Water Transmission Systems 38
Seattle-Everett Interurban Railway *39
The Electrical Show at the Coliseum 41
Personal 41
In Memoriam 41
The Vancouver Power Company ..... †42
Uncle Sam Works Magic in the Northwest 42
Special Evening Lectures 43
Rural Telephone Growth 43
Typical American Hospitality 43
Book Review 43
Trade Catalogues 44
Pacific Engineering Company 46
A Novel Water Hoist *47
Motor Cars for Railroad Work *49
Industrial Engineering *49
Intercommunicating Telephone System *50
The Yosemite Valley and the Big Trees 50
Managers' Meeting 51
Hunt, Mirk & Co 51
Kilbourne & Clark Company 52
Doerr-Mitchell & Co 52
The "Sherwood" Injectors 52
The Merging of Prominent Interests 53
Standard Underground Cable Company 53
An Important Pelton Contract 53
The American Woolen Company 54
The Electric Storage Battery Company 54
Lighting the City of Alpena *54
The Northwest Electric Engineering Company 54
Cascade Gas and Electric Fixture Company 54

News Notes of the Month

Financial xx
New Incorporations xx
Transmission xxii
Railroads xxiv
Telephone and Telegraph xxvi
Electric Light xxviii
Miscellaneous xxx

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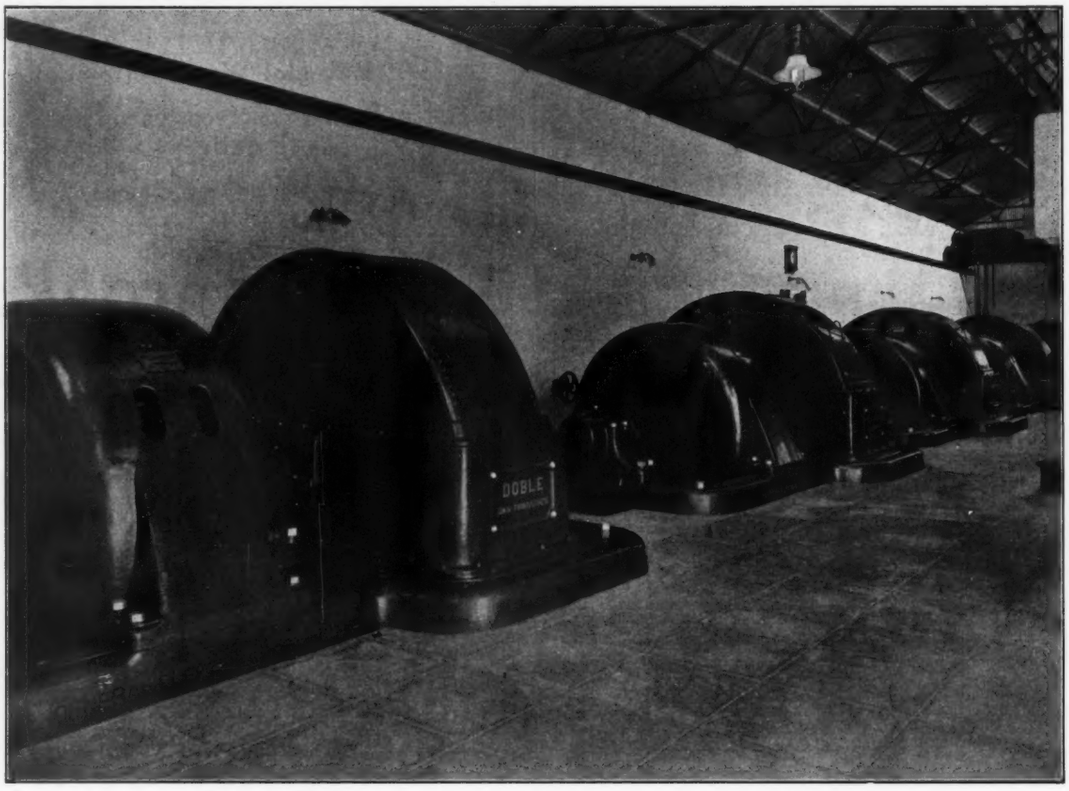
Produce the Greatest Amount of Effective Power from the Least Amount of Applied Energy

Awarded the Grand Prize at the St. Louis World's Fair



Installation of Doble Tangential Water Wheels in the Mill Creek No. 3 Power Plant of the Edison Electric Company. These wheels have been operating continuously for over two and a half years under a head of 1960 feet (850 pounds per square inch). They frequently carry overloads of 33 1-3 per cent. Not a single bucket has had to be replaced. The wheels are equipped with Doble Needle Regulating and Deflecting Nozzles and Ensign Vortex Baffle Plates.

If interested in water power development write for our new Bulletin No. 7

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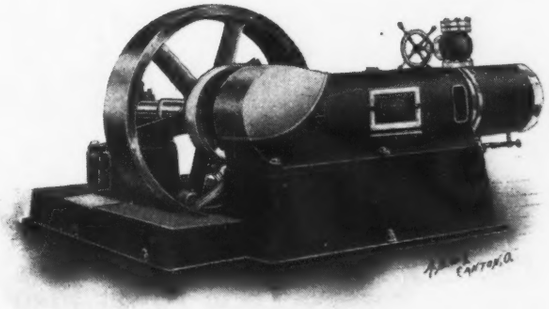
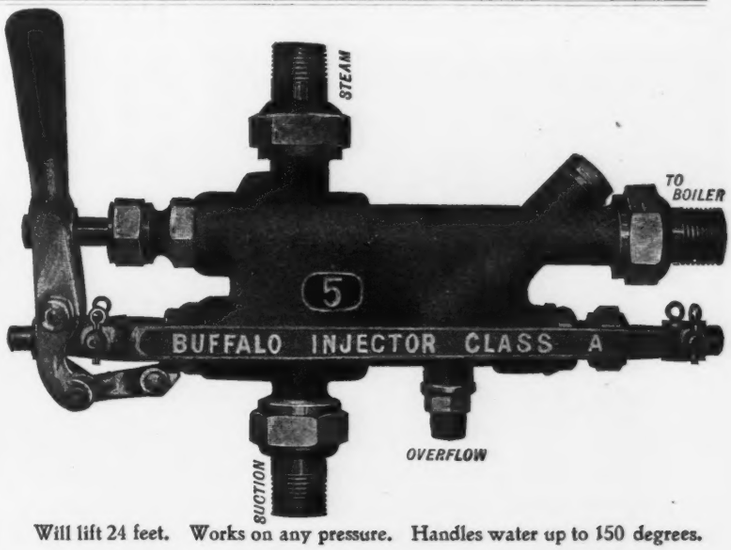
With Sweet's or Rite's Governor

This engine has been specially designed for isolated plants, where the highest efficiency, perfect regulation and quiet running are imperative.





Will lift 24 feet. Works on any pressure. Handles water up to 150 degrees.

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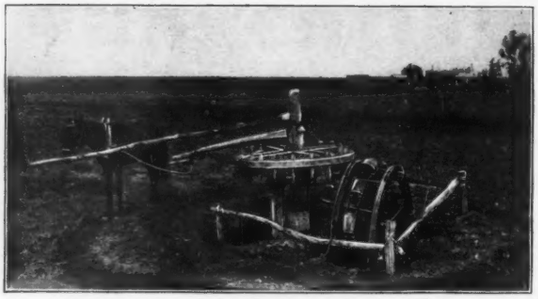
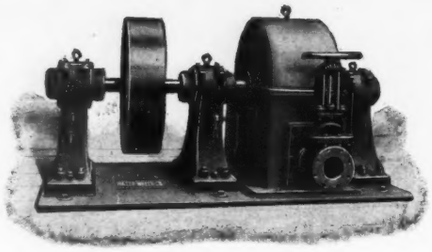


ANCIENT



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Pelton Water Wheel

insures the absorption of the greatest possible energy from the water. A big point about the **PELTON** is that the wheel does not have to carry a load of water around with it. The buckets discharge the water the instant it has transferred its energy to the wheel. That means you reduce the waste power to a minimum by using a **PELTON** wheel for

Electric Power Transmission

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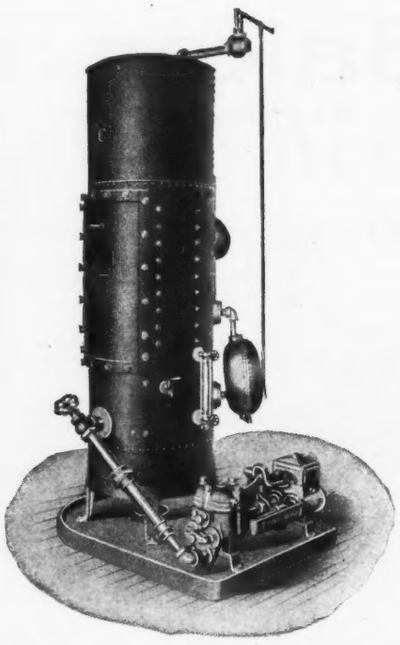

$1.00 Per Day Saved in the Coal Bill by a $240 Investment

That something more than a good boiler and a good engine is needed for economy few men consider when planning a small power plant. In illustration of this fact we shall cite an actual case. A water tube boiler and an engine were installed by a small manufacturer, and at the end of a year it was found that 600 tons of coal had been burned. The owner of this plant was then induced to install a **Stilwell Feed Water Heater** that cost him $240. A year later he found that he had burned 514 tons of coal instead of 600. Thus he effected a saving of 86 tons of coal by making an investment of $240 in a feed water heater. Since the coal cost $3.75 per ton at the plant, the saving in fuel was $322 for the year. In addition to this the boiler needed cleaning much less frequently and was also saved from injury from cold feed water.

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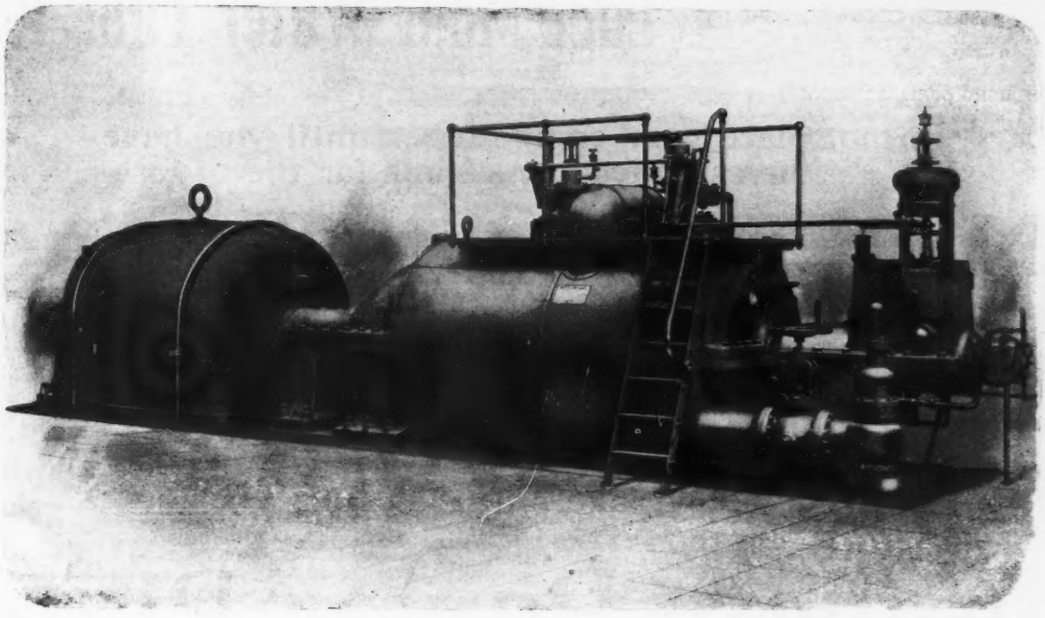

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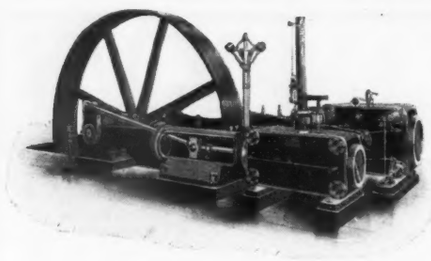

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CLASSIFIED LIST OF ADVERTISMENTS.

Alternators
National Electrical Co....xxxiv

Aluminum
Pittsburgh Reduction Co....xxiii

Batteries, Primary
California Electrical Works....xxxvii
Century Electric Corporation....xii
Doerr Mitchell Co....xxxvii
Electric Appliance Co....xviii
Standard Electrical Works....ii
Western Electric Co....xix

Batteries, Storage
Century Electric Corporation....xii
Electric Storage Battery Co....v

Belt Dressing
Dixon Crucible Co., Jos....xxxiv

Boilers
Edge Moore Iron Works....xii
Moore, C. C. & Co Inc....iv
Standard Electric Works....ii
Hunt, Mirk & Co....xi
Tracy Engineering Co....xii

Boiler Compounds
Dearborn Drug and Chemical Works....xv

Braces
The Lindsley Bros. Co....xxvii

Castings
Thompson Bros....xxxvii

Circuit Breakers
Cole Co., John R....xiv
Cutter Co., The....xiv
Electric Appliance Co....xviii
Fort Wayne Electric Works....iii
Kilbourne & Clark Co....xxi

Conduits
American Circular Loom Co....xiv
Century Electric Corporation....xii
Cole Co., John R....xiv
Electric Appliance Co....xviii

Conduit Fixtures
Electric Appliance Co....xviii

Cross Arms
Carter & Co., George. E....xxxv
Estabrook Co., A. F....vii
Electric Appliance Co....xviii
The Lindsley Bros. Co....xxvii

Dynamos and Motors
Allis-Chalmers Co....xvii
Brooks-Follis Electric Corporation....xxxiii
California Electrical Works....xxxvii
Century Electric Corporation....xii
Fort Wayne Electric Works....iii
General Electric Co....i
Kilbourne & Clark Co....xxi
Northern Electrical Mfg. Co....xix
Standard Electrical Works....ii
Stanley-G.I. Electric Mfg. Co....xl
Westinghouse Elec. and Mfg Co....xviii
Wagner Elec. Mfg Co....v

Electrical Instruments
Cole Co., John R....xiv
Cutter Co., The....xiv
Doerr Mitchell Co....xxxvii
Electric Appliance Co....xviii
Fort Wayne Electric Works....iii
General Electric Co....i
Kilbourne & Clark Co....xxi
Stanley-G. I. Electric Mfg. Co....xl
Westinghouse Elec. and Mfg. Co....xviii
Weston Electrical Instrument Co....iii

Elevators.
Van Emon Engineering Co....xxxiii
Willamette Iron and Steel Works....xix

Engineers, Chemical
Smith, Emery & Co....xxxvii

Engineers and Contractors
Brooks-Follis Electric Corporation....xxxiii
Byllesby & Co., H. M....xxxv
California Electrical Works....xlvi
Cannon, Edward F....xxxvii
Century Electric Corporation....xii
Cole Co., John R....xiv
Copeland Clem A....xxxvii
Cory, Meredith & Allen....xxxvii
Doble Co., Abner....xxxvii
General Electric Co....i
Hall, Leon M....xxxvii
Hippely & Meyers....xxxvii
Hunt, Mirk & Co....xi
Jackson, D. C. and W. B....xxxvii
Kilbourne & Clark Co....xxi
Masson, R. S....xxxvii
Meese & Gottfried Co....i
Moore, C. C. & Co. Inc....iv
Schott, W. H....xxxvii
Standard Elec. Works....ii
Smith, W. Stuart....xxxvi
Stanley-G. I. Elec. Mfg. Co....xl
Sunset Electric and Engineering Co....xlv
Thaxter, H. C....xxxvii
Tracy Engineering Co....ii
Van Der Naillen, A....xxxvii
Wakefield, G. F....xxxvii
Westinghouse Elec. and Mfg. Co....xviii

Engines, Gas and Gasoline
Allis-Chalmers Co....xvii
Moore & Co., Chas. C Inc....iv
Westinghouse Machine Co....xviii

Engines, Boilers, Heaters etc.
Allis-Chalmers Co....xvii
Hunt, Mirk & Co....xi
Moore & Co., Chas. C. Inc....iv
Ohmen Engine Works....xxxiv
Platt Iron Works....x
Standard Elec. Works....ii
Tracy Engineering Co....xii
Westinghouse Machine Co....xviii
Willamette Iron and Steel Works....xix

Gas Engines
Hallidie Machinery Co....xxxi

Hydraulic Machinery
Doble Co., Abner....xxxvii
Dow, Geo. E. Pumping Engine Co....iii
Hunt Mirk & Co....xi
Knight & Co....xxv
Lombard Governor Co....xxiii
Moore & Co., Chas. C. Inc....iv
Pelton Water Wheel Co....x
Platt Iron Works....vi

Ice Making Machinery
Vulcan Iron Works....i

Instruments
Lietz, A Co....xxzvii

Insulators and Insulating Material
Bossert Elec. Cons. Co....xiv
Brooks-Follis Electric Co....xxxiii
Cole Co., John R....xiv
Electric Appliance Co....xviii
Fort Wayne Electric Works....iii
Knowles, C. S....xv
Locke Insulator Mfg. Co....xxxiii
Okonite Co., Ltd....i
Roeblings Sons Co., John A....xv
Standard Underground Cable Co....i

Injectors
The Wm. Powell Co....ix
Baker & Hamilton....ix

Kodaks
Andrews, T. P....ii

Lamps, Arc
Benjamin Electrical Manufacturing Co..xxxix
Electric Appliance Co....xviii
Fort Wayne Electric Works....iii
General Electric Co....i
Standard Elec. Works....ii
Stanley-G. I. Electric Mfg. Co....xl
Westinghouse Electric and Mfg. Co....xviii

Lamps Incandescent
California Incandescent Lamp Co....xxxvi
Electric Appliance Co....xviii
Standard Elec. Works....ii

Lubricators
The Wm. Powell Co....ix
Baker & Hamilton....ix

Machine Tools
Hallidie Machinery Co....xxxi

Mantels
Welsbach Co....xxxvi
Barrett, John Co....xxxvii

Marine and Stationary Air Compressors
Hallidie Machinery Co....xxxi

Motors
Doerr Mitchell Co....xxxvii

Meters, Gas
Pacific Meter Co....xxxix

Oiling Devices
The Wm. Powell Co....ix
Baker & Hamilton....ix

Paint, Insulating
Paraffine Paint Co....xxxiv

Piling
The Lindsley Bros. Co....xxvii

Pins
The Lindsley Bros. Co....xxvii

Pins, Insulator
Hardwood Planing Mill Co....xxxiv
Locke Insulator Manufacturing Co....xxiii

Pipe
Abner Doble Co....xxxvii
Francis Smith & Co....xxxv
Schaw-Batcher Co....xxxiv

Poles, Ties, Brackets etc.
Carter & Co., Geo. E....xxxv
Estabrook Co., A. F....vii
John M. Klein Electrical Co....xxxvii
Klein, Mathias & Sons....xxxv
The Lindsley Bros. Co....xxvii

Posts
The Lindsley Bros. Co....xxvii

Power Plants
Hallidie Machinery Co....xxxi

Power Transmission Machinery
Messe & Gottfreid Co....i
Platt Iron Works....x
Willamette Iron and Steel Works....xix

Pneumatic Machinery
Hallidie Machinery Co....xxxi

Pumps, Centrifugal
Dow, Geo. E. Pumping Engine Co....iii
Knight & Co....xxv
Moore, C. C. & Co. Inc....iv
Platt Iron Works....x

Pumps, Steam
Allis-Chalmers Co....xvii
Dow, Geo. E. Pumping Engine Co....iii
Moore & Co., Chas. C. Inc....iv
Platt Iron Works....x

Rock Drills
Hallidie Machinery Co....xxxi

Roofing
Bonestell, Richardson & Co....xxxiv
Paraffine Paint Co....xxxiv

Shaw Non-Arcing Lightning Arresters
Lord Electric Co....xxv

Steam Plant Equipment
Hallidie Machinery Co....xxxi

Supplies, General Electrical
Brooks-Follis Electric Corporation....xxxiii
Century Electric Corporation....xii
Electric Appliance Co....xviii
General Electric Co....i
John M. Klein Electrical Co....xxxvii
H. W. Johns-Manville Co....xvi
Kilbourne & Clark Co....xxi
Northern Electrical Mfg. Co....xix
Standard Elec. Works....ii
Westinghouse Elec. and Mfg. Co....xviii

Switchboards
Bossert Elec. Cons. Co....xiv
Century Elec. Corporation....xii
Cole Co., John R....xiv
Drendel Switchboard Co....vii
General Electric Co....i
Stanley-G. I. Elec. Mfg. Co....xl
Westinghouse Electric Mfg. Co....xviii
Wagner Elec. Mfg Co....vi

Tape
Cole Co., John R....xiv
Electric Appliance Co....xviii
New York Insulated Wire Co....xiv
Okonite Co., Ltd....i

Telephones and Supplies
Brooks-Follis Electric Corporation....xxxix
California Electrical Works....xxxvi
DeVean Telephone Mfg. Co....xxxii
Doerr Mitchell Co....xxxvii
Electric Appliance Co....xviii
Kilbourne & Clarke Co....xxi

Thomas Soldered Rail Bonds
Lord Electric Co....xxv

Ties
The Lindsley Bros. Co....xxvii

Tile Floring
Barrett, John Co....xxxvii

Transformers
California Electrical Works....xxxviii
Electric Appliance Co....xviii
Fort Wayne Electric Works....iii
General Electric Co....i
Kilbourne & Clark Co....xxi
Western Electric Co....xix
Westinghouse Elec. and Mfg. Co....xviii
Wagner Elec. Mfg. Co....vi

Traps, Steam
Moore, C. C. & Co. Inc....iv

Valves
American Balance Valve Co....xxxii
Moore & Co., Chas. C. Inc....iv
Standard Elec. Works....ii

Water Wheels
Abner Doble Co....xxxvii
Knight & Co....xxv
Pelton Water Wheel Co....x
Platt Iron Works....vi

Water Wheel Governors
Knight & Co....xxv
Lombard Governor Co....xxxiii
Pelton Water Wheel Co....x
Platt Iron Works....x

Wires and Cables
California Electrical Works....xxxviii
Cole Co., John R....xiv
Electric Appliance Co....xviii
New York Insulated Wire Co....xiv
Okonite Co., Ltd....i
Pittsburgh Reduction Co....xxiii
Roebling Sons Co., John A....xv
Simplex Electrical Co., The....ii
Standard Underground Cable Co....i

Whistles
The Wm. Powell Co....ix
Baker & Hamilton....ix

Woodworking Machinery
Hallidie Machinery Co....xxxi

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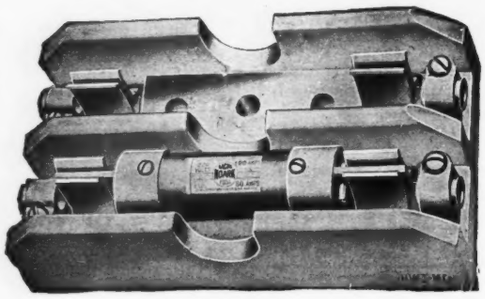
ADVERTISERS' INDEX.

	PAGE
Abner Doble Company	viii, xxxvii
Allen, Wyatt H	xlv
Allis-Chalmers Co	xvii
American Balance Valve Company	xxxii
American Circular Loom Co	xiv
Andrews, T. P	iii
Baker & Hamilton	ix
Barrett Co., John	xxxvii
Benicia Iron Works	xxxvi
Benjamin Electrical Manufacturing Co	xxxix
Bonestell, Richardson & Co	xxxiv
Bossert Electric Construction Co., The	xiv
Brooks-Follis Electric Corporation	xxxiii
Brown-Spear-Sloan Co	xxxix
Byllesby, H. M. & Co	xxxv
Classified	xiii
California Electrical Works	xxxviii
California Hydraulic Eng. and Supply Co	xxxii
California Incandescent Lamp Co	xxxvi
Cannon, Edw.	xxxvii
Carter, George . & Co	xxxv
Century Electric Corporation	xii
Cole, John R. Company	xiv
Copeland, Clem A	xxxvii
Cory, C. L	xlv
Cutter Co., The	xiv
Dearborn Drug and Chemical Works.	xv
Doerr, Mitchell & Co	xxxvii
Drendell Switchboard Co	vii
Dow Pumping Engine Co	iii
DeVean Telephone Mfg. Co	xxxii
Eslabrook Co., A. F	vii
Engineering Office	xxxvii
Edge Moor Iron Works	xii
Electric Appliance Company	xviii
Electric Storage Battery Co., The	v
Fort Wayne Electric Works	iii
General Electric Co	i
Hardwood Planing Mill Co	xxxiv
Hall, Leon M	xxxvii
Hallidie Machinery Co	xxxi
Heald's Business College	xxxvii
Hemingray Glass Co	xxxiii
Hippely & Meyers	xxxvii
Hunt, Mirk & Co	xi
Jackson, Dugal C. and William B	xxxvii
Johns-Manville Co., H. W	xvi
Joseph Dixon Crucible Co	xxxiv
Kilbourne & Clark Co	xxi
Klein, Mathias & Son	xxxv
Klein, Jno. M. Electric Co., Inc	xxxvii
Knight & Co	xxxv
Knowles, C. S	xv
Lietz Co., A	xxxvii
Lindgren-Hicks Co	v
Lindsley Bros. Co	xxvii
Locke, Insulator Mfg Co	xxiii
Lombard Governors	xxiii
Lord Electric Co	xxv
Masson, R. S	xxxvii
Meese & Gottfried Co	i
Meredith, Wynn	xxxvii
Moore, Chas. C. & Co., Inc	iv
National Electrical Co	v
National Conduit Cable Co	xxxiv
New York Insulated Wire Co	xiv
Northern Electrical Mfg. Co	xix
Occidental Machinery Co	xxix
Ohmen Engine Works	xxxiv
Okonite Co., The (Ltd.)	i
Pacific Meter Co	xxxix
Paraffine Paint Co., The	xxxiv
Pacific Engineering Co	xxxiv
Pelton Water Wheel Co	x
Pittsburgh Reduction Co., The	xxiii
Platt Iron Works	x
Powell Company, The	ix
Portland General Electric Company	xxxi
Roebling's Sons Company, John A	xv
Schaw-Batcher Company Pipe Works, The	xxxiv
Schott, W. H	xxxvii
School of Practical Engineering	xlv
Seattle Electric Co	xxxvi
Simplex Electrical Co., The	ii
Smith, Emery & Co	xxxvii
Smith, W. Stuart	xxxvii
Smith, Francis & Co	xxxv
Standard Electrical Works	ii
Standard Underground Cable Co	i
Stanley-G. I. Electric Manufacturing Co	xl
Sunset Electric and Engineering Co	xxxvii
Thaxter, H. C	xxxvii
Thompson Brothers	xxxvii
Tracy Engineering Company	xii
Van der Naillen, A	xxxvii
Van Emon Engineering Company	xxxiii
Vulcan Iron Works	i
Wagner Electric Manufacturing Co	vi
Wakefield, G. F	xxxvii
Welsbach Co	xxxvi
Westinghouse Electric and Manufacturing Co., The	xviii
Westinghouse Machine Co., The	xviii
Weston Electrical Instrument Co	iii
Witt, G. E. Co	vii
Willamette Iron and Steel Works	xix
Western Electric Works	xxix
West Coast Machinery Company	xxxiii
Yawman & Erbe Manufacturing Company	xxxv



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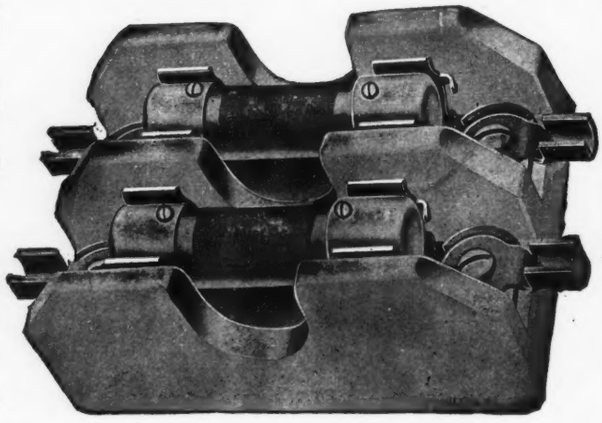

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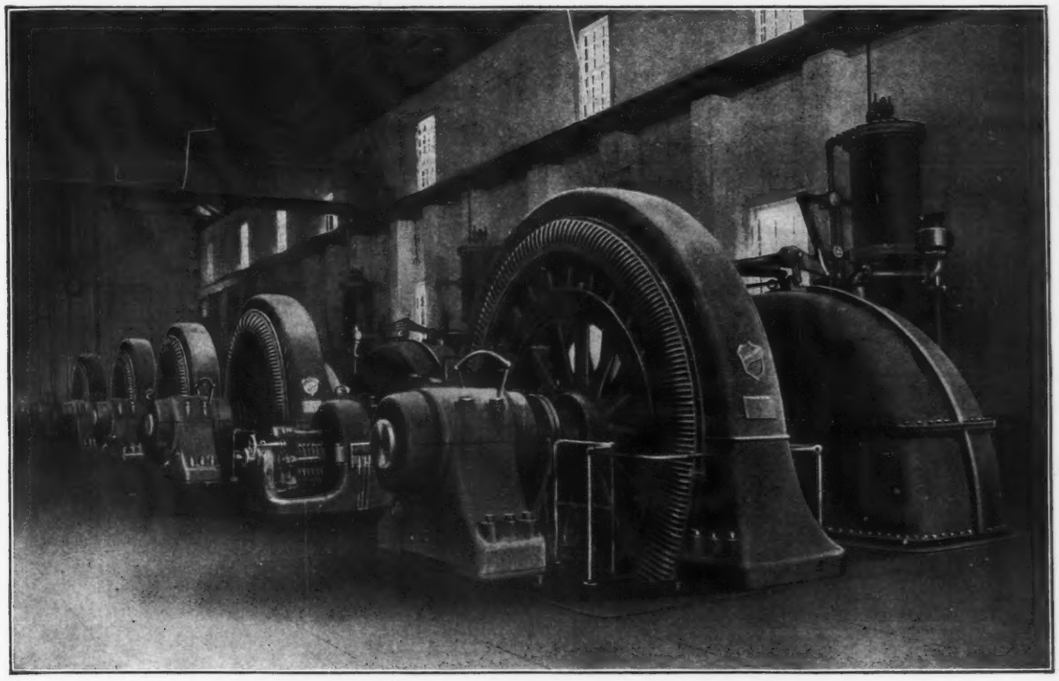

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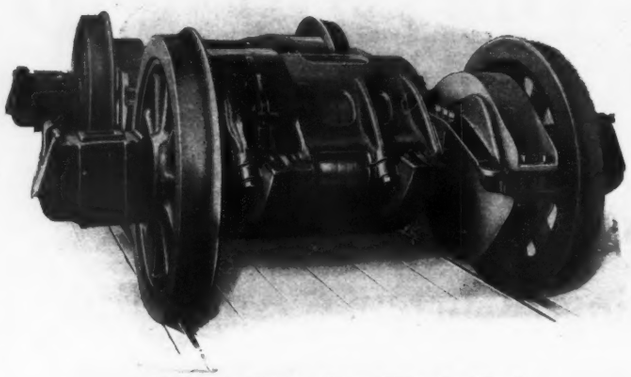

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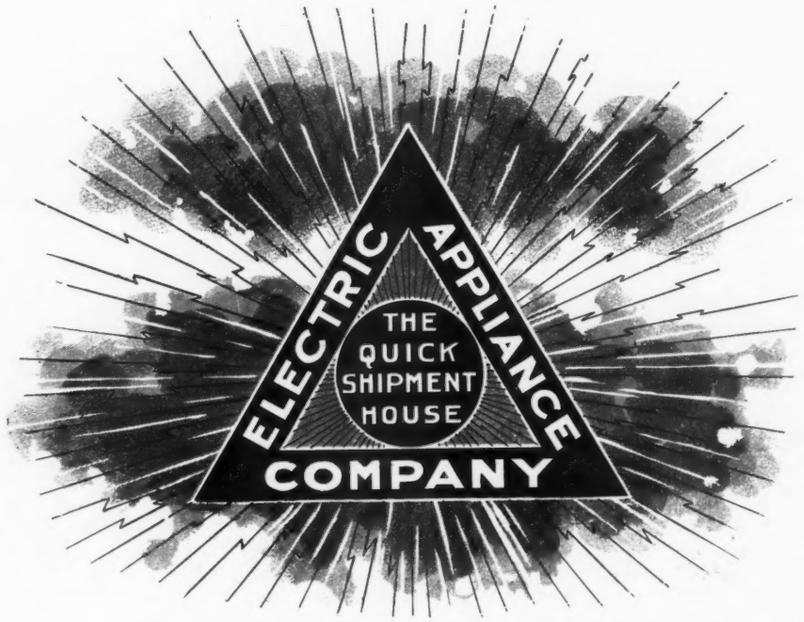

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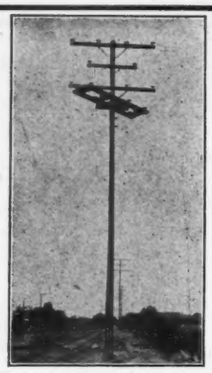

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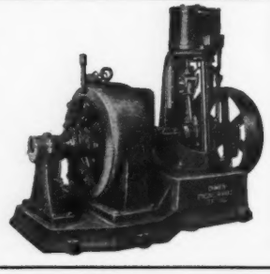

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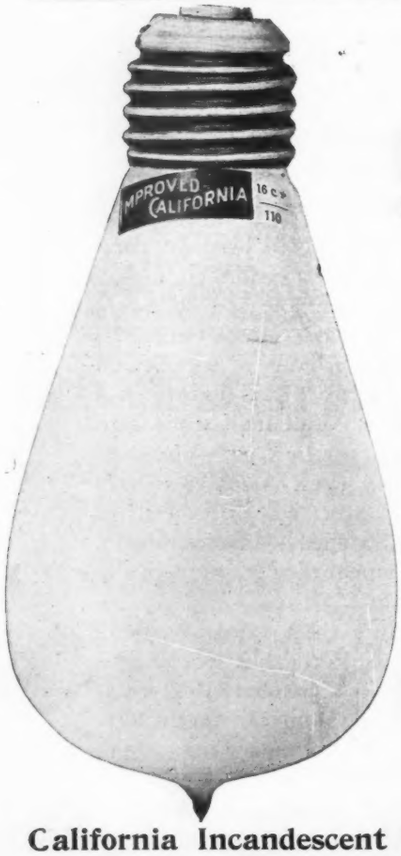

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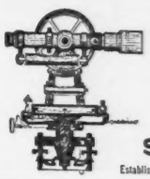
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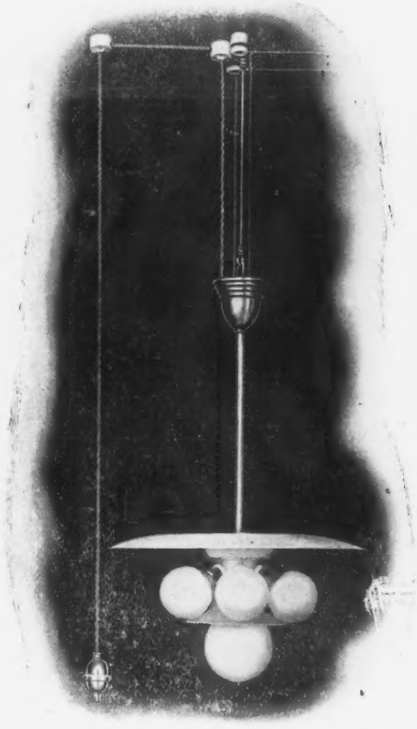

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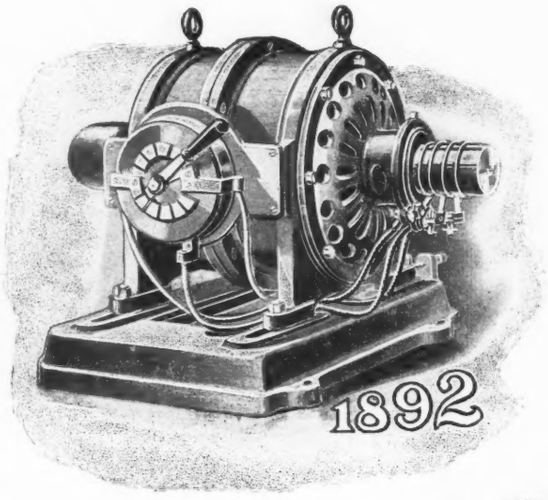

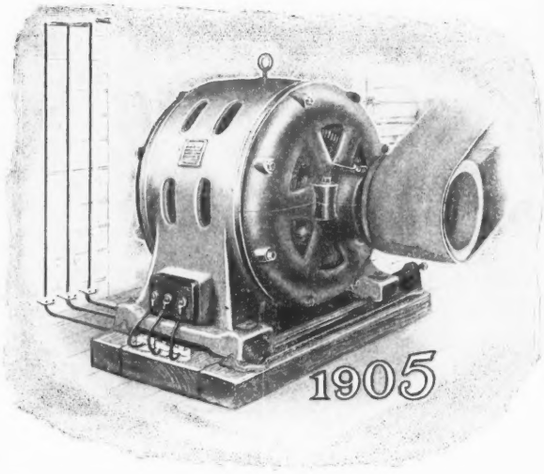

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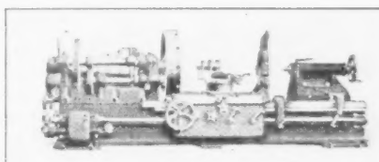

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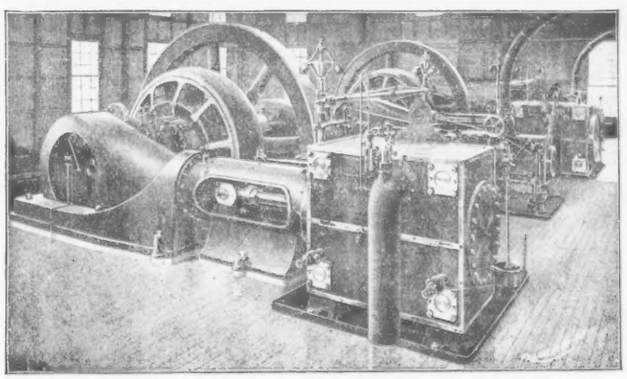

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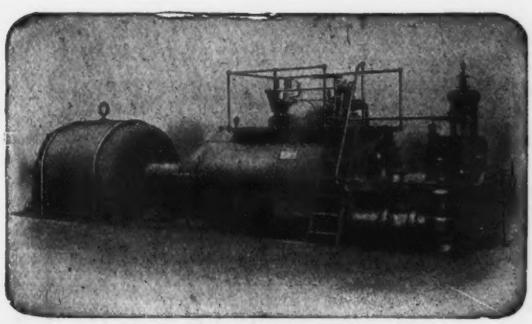

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ADVERTISERS' INDEX

Allen, L. B. & Co..... x
Allis-Chalmers Co. i
American Circular Loom Co..... xiv
American Conduit Co. v
Aylsworth, H. G. v
Barrett Co., The John xiii
Bay Shore Elec. Construction Co.. xv
Benicia Iron Works..... vi
Benjamin Electric Mfg. Co..... vi
Bonestell, Richardson & Co..... xiii
Bossert Electrical Construction Co. xiv
Brooks, Follis Elec. Corporation.... x
Brown-Spear-Sloan Co. xi
Bylisby & Company, H. M..... iii
California Electrical Works..... xiv
California Incandescent Lamp Co.. x
Carte. Geo. E. Co..... x
Century-Klein Electric Co., Inc... xvi
Cook, Frank B. vi
Dean Electrical Company..... xii
Dearborn Drug and Chem. Works.. xiii
Doble Company, Abner xiii
Electric Appliance Co..... viii
Eureka Drafting Room..... xiii
Electric Storage Battery Co., The v
Fort Wayne Electric Works..... i
Goeriz & Co., O. C. vi
Gould Storage Battery Co..... iii
Guarantee Electric Works x
Hallidie Machinery Co. i
Hemingray Insulators xv
Holtzer-Cabot Electrical Co..... ix
Hunt, Mirk & Co..... iii
Johns-Manville Co., H. W..... v
Keystone Boiler Works..... xv
Kilbourne & Clark Co..... iv
Leitz, A. & Co..... xiii
Lima Insulators xvi
Lindgren-Hicks Co. xiii
Mechanical Appliance Co., The.... iv
Meese & Gottfried Co..... i
Moore, Chas. C. & Co., Engrs., Inc. xvi
National Brake & Electric Co..... i
National Conduit and Cable Co.... i
Northern Electrical Mfg. Co..... v
Nungesser Electric Battery Co.... vi
Ohmen Gas Engine Co..... xiii
Okonite Co., The..... i
Olliver Manufacturing Co. vi
Pacific Engineering Co..... xii
Pacific Fire Extinguisher Co. x
Pacific Meter Co..... v
Paiste, H. T. Co..... x
Paraffine Paint Co., The..... xiii
Parker Water Tube Boiler..... xv
Pacific Electric & Mfg. Co..... xvi
Pass & Seymour viii
Partrick, Carter & Wilkins Co.....
Pelton Water Wheel Co..... v
Phoenix Glass Co., The..... iv
Pierson, Roeding & Co..... vii
Professional Cards xiii
Risdon Iron Works iv
Rix, C. A. & D. Co.....ix-xi
Roebling Sons Co., John A..... xvi
Seattle Electric Co..... iii
Simplex Electrical Co., The..... iii
Smith, Francis & Co..... x
Standard Electrical Works..... ii
Standard Underground Cable Co. i
Tracy Engineering Co..... xv
The Mechanical Appliance Co..... iv
United States Cast Iron Pipe and Foundry Co. vi
Van Emon Elevator Co..... xiv
Vulcan Iron Works..... i
Wagner Electric Co. xi
Welsbach Company xvi
Westinghouse Elec. & Mfg. Co.... viii
Weston Electrical Instrument Co. xiv

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CONTENTS

Electric Gold Dredge No. 3, of Conrey Placer Mining Co., at Ruby, Mont. 535
Alternating Current Networks 537
High-tension Lightning Protection 537
Electrical Frauds 539
The Effects of High Pressure upon Illuminating Gas 540
Duration of Flashes of Lightning 541
Organization and Conduct of a New Business Department Suitable for Central Stations in Cities of Fifty Thousand Population and Under 542
EDITORIAL—
Power in the West 544
Magazine Notes 544
Personal 545
Trade Catalogues 545
Torsion in Engine Shafts 545
Gas Turbines 545
A Dynamometer for Small Boats 545
Leakage in Compressed Air Plants 545
The Economics of Electric Cooking 546
Fires Caused by Electricity and Gas 548
A Low Voltage Shop Trolley Circuit, and some of its Advantages 549
INDUSTRIAL 550
NEWS NOTES 552

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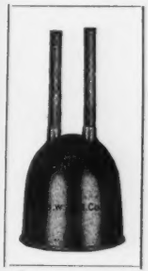
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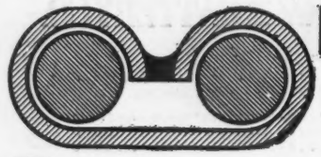

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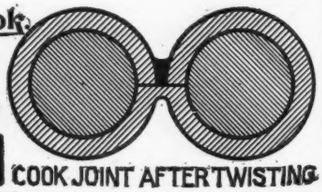

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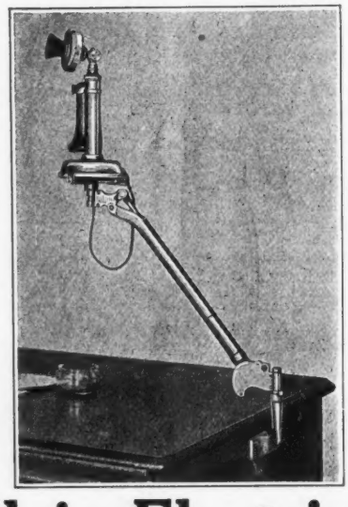

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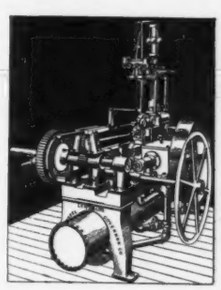

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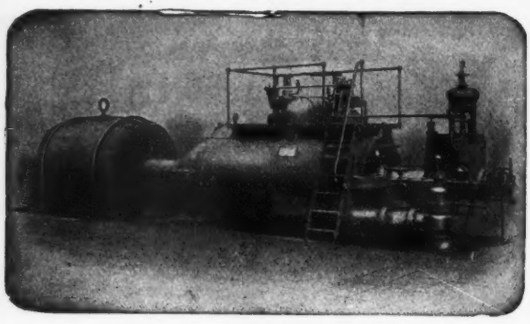

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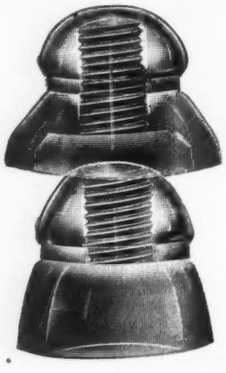

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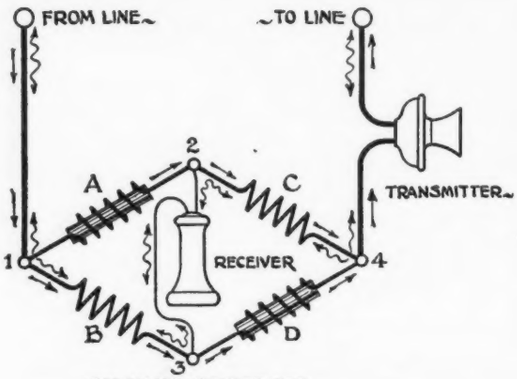

FIG. 1

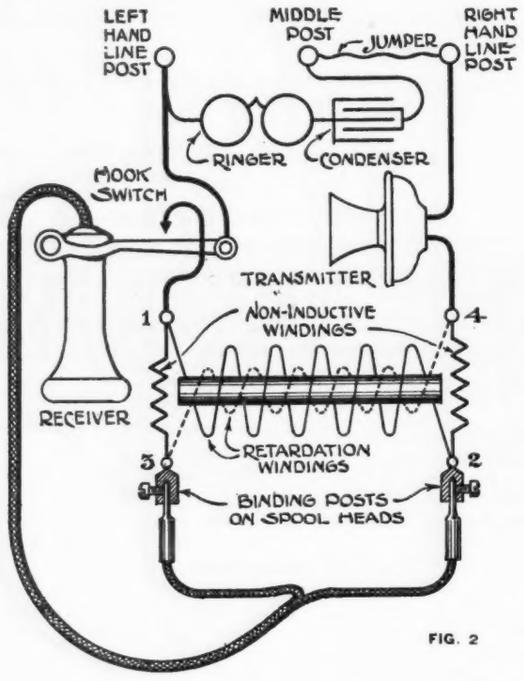

FIG. 2

In Figure 2 is shown the actual wiring of our common battery telephone with the balanced Wheatstone bridge coil as it is employed in practice, keeping the direct current flow from the receiver, while the voice current, which is alternating in effect is received at maximum value, thus with the Dean transmitter and receiver the service received from our common battery telephone is of the highest efficiency--the reason for the great demand.

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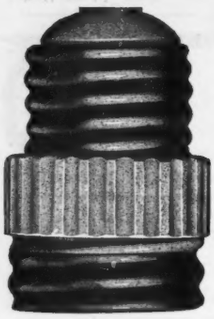

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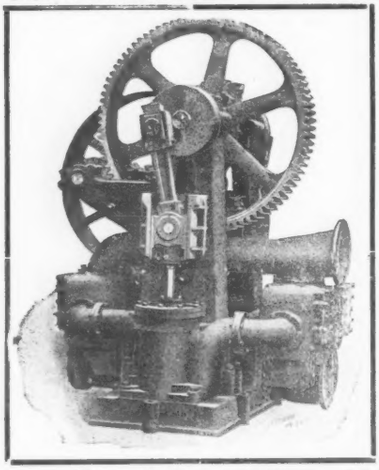

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